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The Noranda Enterprise

Description of the Rich Ore Deposits and the Methods of Mining at the Company's Horne Mine in the Rouyn Area in Northwestern Quebec

By A. H. Hubbell

An Unusual Fluorspar Deposit

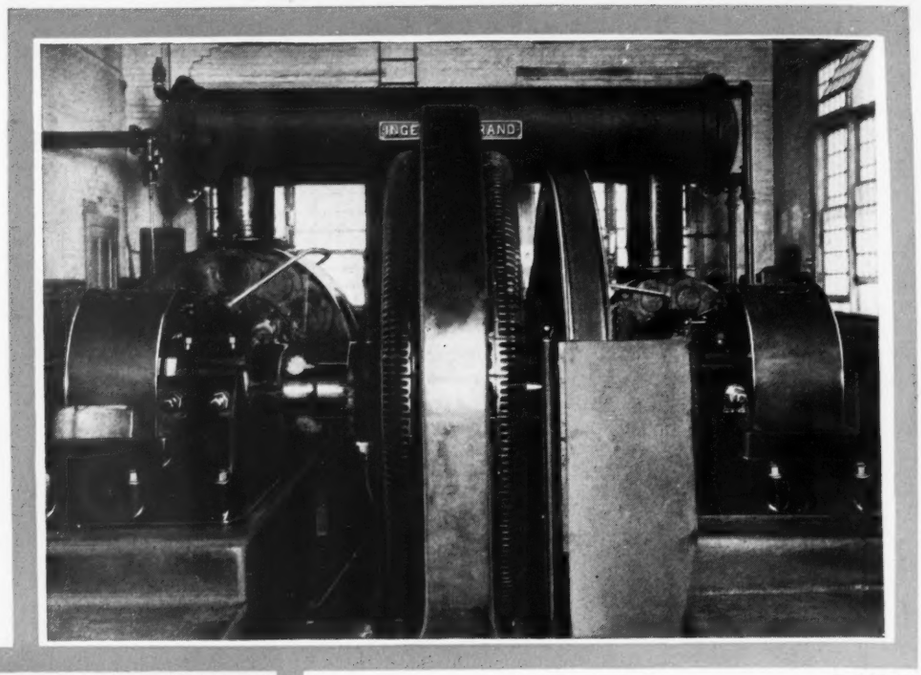
Differs from the Nearly Vertical Veins of the Rosiclare District. A Replacement in the Lime

By Martin Schwerin

Salt Roasting and Cyaniding at Achotla, Mexico

Novel Combination of Well Known Processes Gives Excellent Metallurgical Results

By E. R. Richards



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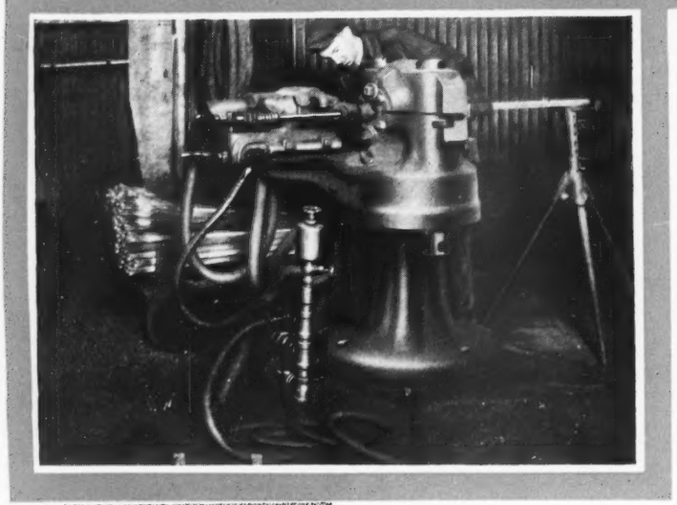

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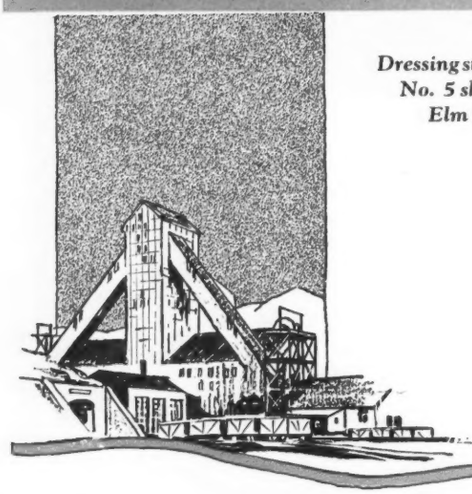

Dressing steel on a "Leyner" No. 5 sharpener at the Elm Orlu Mine.

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The Motor Truck May Solve Your Transportation Problem

IMPROVED state highways and the construction of private roads, the development of dependable and efficient gasoline engines—these combined to direct attention to the value of the motor truck as a means of transporting feldspar in North Carolina from mine to plant or railroad; and within five years the change was effective over 70 per cent of the operations in the district. Facts and figures will be found in an interesting article by Mr. S. T. Henry, of Spruce Pine, N. C., scheduled to appear soon. One feature of the work was the use of low-grade feldspar in the ballasting of the road. A significant result is the low cost of haulage. In one instance, team haulage cost $2 per ton. Motor trucks now do the job for half this sum. Their flexibility as transportation units is an additional advantage.

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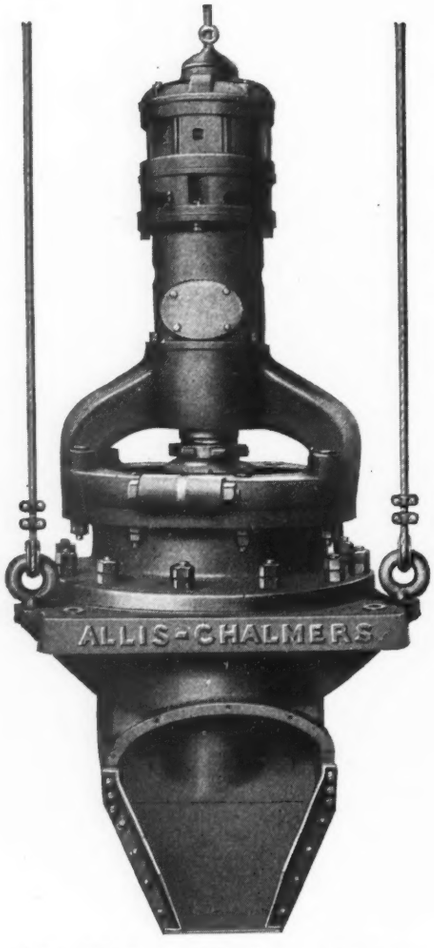

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ENGINEERING AND
MINING JOURNAL

McGraw-Hill Publishing Company, Inc.
JAMES H. McGRAW, President

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Editor

VOLUME 126 · New York, September 1, 1928 · NUMBER 9

Sincerity as a Lubricant in International Relations

ACCORDING to a dispatch from Washington, developments in connection with the suits brought by the United States Department of Justice against the German and French potash producers, and against the Kina Bureau in Holland, indicate that European business men fail to grasp the purport of the United States anti-trust laws; which is not surprising, as most American business men are equally perplexed. European countries have come to regard cartels as in the public interest, and as tending to encourage maximum efficiency, continues the dispatch; to which one might add that the United States evidently thinks along much the same lines, to judge by the success of groupings in this country that differ from the European cartels only in designation; to say nothing about the associations of manufacturers and producers encouraged by the Webb-Pomerene Act. In spirit, the United States, especially when faced with foreign competition abroad, is in favor of the cartel system. It is only in the domestic market that pretence goes hand in hand with an enforcement of outworn legislation that hampers progress and encourages the waste of national resources.

Official Washington seems to be of the opinion that these invasions of the United States Department of Justice abroad have had the effect of calling attention to the fact that the anti-trust statutes can be used in behalf of American business as well as against. In comment on this pronouncement, no dispute will arise in regard to the contention that the Sherman Act has operated against the best interests of American business in many instances. However, *Engineering and Mining Journal* protests against the enforcement of an American act abroad to protect American business at home, particularly in view of the insincerity involved. As was maintained by this publication in criticism of the recent action of the Department of Justice in its attacks on the Canadian asbestos producers: It is surely a strained sense of justice that permits and encourages domestic combinations to "conspire" in the fixing of prices for the export market, and views as immoral, unmoral, and altogether reprehensible the formation of any similar combination of producers that is exporting the resultant product to the United States.

In regard to asbestos, the action of the department not only creates resentment across the border, but it will have the effect of making it impossible for the domestic producer of asbestos to exist. To force acceptance of the fetish of cheapness at any cost in this instance merely invites international ill-will and diminishes the respect with which the United States is held in foreign countries.

Effect of Unrestricted Competition Among Professional Engineers

COMPETITION has been said to be the life of trade, but occasionally it involves the death of the trader. If unrestricted price cutting is a sound policy, as some aver, it should apply equally well to the purchase of services as to the purchase of goods. As a matter of fact it is being so applied, but with uniformly disastrous results, because the salary earner is seldom in a position to bargain. He and his family need subsistence, the minimum requirements for which are too often taken by the employer as determining the maximum recompense that will be given for his services.

The trader is not obliged to cut prices; neither is the employee obliged to accept a minimum-subsistence salary. The former can obtain credit and, perhaps, without personal loss, he can go bankrupt. The latter, usually unable to raise working capital on assets no more tangible than education, training, experience, ability, and zeal, can change his occupation. In the engineering field this is precisely what he does. The National Industrial Conference Board shows this diagrammatically in a series of charts. Graduates in all branches of engineering are inclined to forsake their chosen callings. After five, fifteen, and twenty-five years, the percentage of those still employed in engineering work, as studied at the universities of Harvard and Lehigh, was, respectively, as follows: Harvard—82.1, 59.0, and 47.2 per cent; Lehigh—54.0, 51.8, and 37.7 per cent.

Oversupply of a commodity in a limited market calls for control to prevent price collapse; and the lesson of restriction of output is soon learned. Not so with engineering service, however. In an interesting paper on the economic status of the mechanical engineer, by Mr. T. H. Normile, research engineer of the United States Department of Agriculture, delivered recently before the Council of the American Society of Mechanical Engineers, this failure was emphasized. The engineering profession as a whole shows a growth in membership unwarranted by present or prospective demands; and it is not surprising, therefore, that Professor Irving Fisher, in an analysis of incomes in the United States, includes "most engineers" in the "poorest class."

The professions of law and medicine have discouraged unhealthy growth in membership, thereby avoiding, to some degree at least, the poverty and loss that have been the lot of so many mining engineers in recent years. Figures from the Bureau of Census Reports, cited by Mr. Normile, indicate that whereas the number of mining engineers in the United States increased 130 per cent between 1900 and 1920, the increase in membership

in the medical and legal professions, respectively, in the same period was only 13 and 7 per cent.

The men responsible for the direction of organized trades in the United States have been more wise, and much of the increase in wages enjoyed by artisans in recent years is due to the fact that a radical reduction in the supply of such labor has been planned and carried into effect. Wider distribution of wealth, the increase of educational facilities, and the attractiveness of the so-called professions have resulted in an unjustifiable increase in the ranks of engineering graduates. The proportion of desertions to other fields of endeavor is indicative of misplaced effort and economic waste. Engineering schools, instead of seeking ways and means of swelling ranks that are already overcrowded, should apply research and resources in an attempt to help engineering alumni to obtain a fair return on a heavy investment of time and money in the acquisition of training and experience. It is equally important that the professional ranks of mining engineering should be strengthened, ethically and technically, by the exclusion of those without standing or record, who absorb fees and salaries that should be distributed among accredited members of the profession, many of whom are forced to write off education and experience in specialized work as a total loss because opportunity is lacking for advance and sometimes for employment that would insure at least a bare existence.

Standard Metallurgical Equipment Penetrates Into the Paper Industry

A TRIBUTE to the thoroughness with which the metallurgist and the ore-dressing engineer have tackled the mechanical problems of reduction is seen in the adaptation, if not the adoption unaltered, of standard ore-milling equipment in other industries. One of the latest successes is reported from the pulp and paper field, where the open-end rod mill is effecting radical savings in the cost of disintegrating treated or untreated wood pulp and other fibrous material used principally in the manufacture of newsprint. No engineer who has studied the mechanics of paper production can fail to be impressed with the clumsiness of many of the stages of processing, and the disregard of principles demonstrated as fundamental in the reduction of ores. Despite the undesirable features of the familiar paper-mill "beater," it has remained a standard article of equipment until the rod mill demonstrated the advantage of a correct consistence in the pulp being disintegrated. This desired consistence in what may be termed a metallurgical mill may be insured by the adoption of a low pulp level. The fibers, caught between the rods, are given a true beating action, without the cutting that occurs in the standard machine misnamed a "beater."

As in metallurgical grinding, a too-thin paper pulp connotes waste of power and excessive consumption of rods and liners. The success of standard ore-grinding equipment in the paper and pulp industry may be gaged by the fact that a power economy sometimes exceeding 50 per cent has been secured in the shredding phase of operations; and power is one of the costliest factors in the reduction of the wood to a fiber of desirable dimensions and strength.

This example of the invasion of one specialized field with equipment and principles from another and distinct field indicates that there is still plenty of constructive work in the world to be done that is awaiting the initiative of the non-ferrous metallurgist and the ore-dressing engineer.

Promoting Free Movement of the Tools of Progress

AMONG ENGINEERS with a truly international viewpoint may well be included Mr. Alfred James, honorably known as a metallurgist, who, insistent on the recognition of sound technical principles and the value of courage in their application on a large scale, played so important a part in the application—one might almost say the adaptation—of the MacArthur-Forrest cyanide process to the treatment of gold ore and tailing. Mr. James is an ex-president of the Institution of Mining and Metallurgy, of London, but he is well known beyond the British Empire, chiefly by reason of the annual contact he preserves among precious-metal technicians by a stimulating Christmas letter, which we were privileged to publish late last year.

Mr. James has recently returned to England from an extensive trip abroad, and in our issue of June 16 a dispatch was printed from our Melbourne correspondent, who quoted Mr. James as saying, *inter alia,* that "Of Australian industry in general, the principal burden imposed on it in recent years was the price it had to pay for the development of manufactures." Kalgoorlie had led the world in metallurgical practice, he continued, but the economic situation today did not encourage gold mining. He suggested that the government should remit, for a period of five years, all duties on imported mining machinery. Such a step would encourage research and prove a great incentive to progress, he felt, and it would also present to the manufacturing industry of Australia patterns of up-to-date machines. Mining is a competitive industry. Metal has to be produced within the world price, or the mines shut down. Australia should have the benefit of not only the latest proved appliances, but of the other advantages freely extended to her competitors. Another suggestion Mr. James made was that the fuel freight rates should be reduced.

We have since been advised that Mr. James' plea was accompanied by a strong statement, linked with a warning. He also said: "Non-interchange of ideas between Kalgoorlie and the rest of the world—particularly America—has produced stagnation. Stagnation means decay. Decay means death." The desired result was achieved. The duty on certain machinery has been lifted, and a reduced freight rate on fuel substituted for the one that worked a hardship on the industry.

In credit for this forward movement, tribute is due also to the enterprise and fostering statesmanship of the Premier of Western Australia, the Hon. Philip Collier, whose farsightedness will do much to encourage a return to the prosperity that characterized the Western Australia of the old days—by the introduction of methods and machinery that have made economical production possible elsewhere.

"Kalgoorlie led the world in metallurgical practice," says Mr. James. This is no idle boast. As was stated in an article published in *Engineering and Mining Journal* last year, an example of typical technical and economic result was shown by the achievement at the South Kal-

gurli in the early years of the present century: A sulphotelluride ore was fine ground, roasted, slimed, agitated with cyanide solution, and filter pressed, with an actual recovery of 94 per cent; and at a total cost, from rock breaker to disposal of residue, of 11s. 5d. per ton. As was then maintained, considering the fact that fuel (wood) was scarce and expensive, that climatic and living conditions during most of the year were severe and unpleasant, and that all water needed had to be brought under pump pressure for several hundred miles, these results indicate a technical keenness and competency unexcelled in the history of the process.

Many of the engineers and metallurgists associated with the progress made in the early years of Kalgoorlie's development have scattered to all parts of the globe. *Engineering and Mining Journal* hopes that one of them will be the next President of the United States. Some remain in Australia to uphold the fine traditions of early days; and the Kalgoorlie School of Mines is creating for itself a standing in the industry by its excellent work on flotation. It is a matter for congratulation that communication can be maintained as a result of the occasional visits and the inspiring comments of so forceful an individual as Mr. James, and the willing co-operation of governments and of a virile branch of the engineering journalistic profession whose parish is the world of technical endeavor and engineering achievement.

Power From the Ocean—Still Another Scheme

THE temperature of sea water in the tropics varies, according to the depth, to a much greater degree than elsewhere. This circumstance is the foundation of an ingenious scheme proposed by two Frenchmen, to provide power at a cost alleged to be far below that involved by the adoption of customary methods. "What our uninhabited tropical deserts need," says Dr. E. E. Slosson in a recent issue of *Collier's,* "is cool air for homes, pure water for farms, and cheap power for factories." The scheme proposed by the Frenchmen is based on sound principles, he avers, but "How it will work on a large scale and whether it would pay are questions that will have to be determined by trial." One might suggest that the expense of the proposed trial at Havana, using wood pipes, should be delayed pending a closer analysis of the plan. In the first place, what is the extent and what are the potentialities of "our uninhabited tropical deserts," situated at that proximity to the sea necessary for the consummation of the plan? Is there a crying need for pure water in the tropics, where the rainfall is usually so heavy? That opportunity exists for the utilization of cheap power almost anywhere is readily admitted.

The Claude-Boucherot method is simple, on paper, and involves (1) the raising of large volumes of cold water from an ocean depth of, say, 3,300 feet, where the temperature is constant at about 41 deg. F.; (2) the use of this water in a condensing system that effects the vaporization of surface ocean water at about 77 deg., and (3) the utilization of the power developed in the "boiling" of the surface water at a reduced pressure, such reduction being caused by the evacuation of air in the apparatus. Vast quantities of cooling water are necessary; and, as the rise in temperature during passage through the condenser will amount to only a few degrees, it is proposed that "it could be conveyed by refrigerating coils through the houses, run in rivulets down gently inclined planes under factory roofs, sprayed as fountains in the courts, and finally discharged in streams through the streets to the sea."

Admitting that power can be produced in such a system, have the inventors taken into consideration the fact that it will be needed in fairly large quantities for pumping and the maintenance of a vacuum in the apparatus? It is claimed that the vaporization of 1,300 cubic yards of surface water per second by this method would produce 400,000 kilowatts of power; but the amount of cooling water needed to be drawn daily from the depths of the ocean is beyond the capacity of our calculating machine.

The most insistent problem, however, would seem to be a mechanical one: It is feared that wooden pipe would not prove docile during the constructional period unless heavily weighted. And wood, or some similar material, is needed for its insulating properties. Is the pipe to be suspended, or is it to rest on its bottom? In either case, what about the effect of tidal flow? The required depth of over 3,000 feet is usually at a considerable distance from the shore. The problems involved in laying such a pipe may be gaged by visualizing a mountain of the same height. Any type of intake screen would seem impracticable. In fact, even an open pipe might soon become incrusted with marine growths. Finally, assuming that all these obstacles have been overcome, what about the myriads of underwater insects that infest the tropic seas and riddle wood with holes within a few weeks of its immersion?

A careful consideration of many probable results of the experiment is advisable before the expense of a trial on a large scale can be justified. If the inventors could abstract the gold in the vast amount of sea water they plan to handle, the proposal would be even more picturesque, but no more convincing as a profitable scheme.

Atmospheric Conditions Affect Mental as Well as Physical Output

INDUSTRY has concentrated major attention on the problem of inventing processes and perfecting equipment, from which an ever-increasing efficiency has been obtained. Costs per unit produced have been lowered and output has been increased. An equally important avenue for improvement—in the care of the healthy human machine—has failed to attract the attention it deserves, although in some quarters a sincere effort has been made to conserve and promote the employees' physical and mental well-being.

An illogical line of demarcation is usually drawn between the worker in the plant and the worker in the office, where duties are usually too varied to permit of definition or classification. But the personal element is the factor of supreme importance, whether mental or physical attributes are being utilized.

Industry, despite the funds at its disposal, seems to fail to keep pace with science, perhaps forgetful of or indifferent to the fact that common sense, the handmaid of science, has demonstrated the logic and good business of going beyond the obvious opportunities for profit

in the field of quantity production, intensive salesmanship, maximum turnover, and high-pressure output. The fatigue of metals has been studied with scientific thoroughness, and the steel industry, for one, has taken full advantage of the findings. But complaint of fatigue or evidence of declining interest and care on the part of the worker, be his task a mental or a physical one, is too often looked upon as denoting malingering, lack of zeal, or plain stupidity.

WHEN gross output is affected unfavorably, as distinct from individual output, an investigation usually follows. In mines, for instance, the condition of the atmosphere may account for a rapid physical deterioration, if not an infection, reflected in a decline in output per man. A realization of this inefficiency has led to an intensive study of atmospheric conditions underground, and research has proved that, under certain common conditions, human effort is aided or hampered according to the degree of movement of the air, as much as or more than by its temperature, humidity, and chemical composition. Dr. Leonard Hill has defined what he terms the physiological saturation deficit as the difference between the water content of the surrounding air and its content if it were saturated at the temperature of the body. In other words, relief from oppressive atmospheric conditions depends on the ability of the body to be cooled by evaporation of water from its surface; and this evaporation, possible so long as the surrounding air is of a temperature lower than that of the body—almost invariably the condition—is hastened by air movement.

This is the crux of the matter; herein lies the solution of the problem. Atmospheric stagnancy, especially when accompanied by high temperature and high humidity, or even moderate temperature and high relative humidity, inhibits bodily comfort; it is the greatest cause of that mental and physical inertia supposed to be due alone to temperature and humidity.

The reasons for discomfort under trying atmospheric conditions indoors are seldom the subject of deep analysis. The immediate call is for "fresh air." A window may be opened and relief experienced; but in 999 instances out of 1,000 the favorable effect resulting is merely due to accelerated air movement. Circulation is usually sufficiently vigorous to offset the fact that the so-called fresh air is sometimes far more contaminated and at a higher temperature than is the air against which complaint is directed. It may be heavily fouled with factory fumes or automobile exhaust gases. A room may feel "stuffy," even though the air therein may be 100 per cent pure.

TO permit an accurate determination of a composite and comparative figure indicating the condition of an atmosphere so far as its effect on the human machine is concerned, Dr. Hill devised what is known as a katathermometer. The resultant obtained is derived from a measure of the prevailing temperature and humidity of the air, but it also is affected by the degree of its movement. Despite the practical value of the instrument as a means of indicating the cause of low output and decreased mental and physical efficiency, it is little known.

With a few outstanding exceptions, the design of modern buildings indicates an indifference to the facts disclosed by careful and painstaking scientific investigation—a lack of recognition of the demonstrated truism that ventilation and air conditioning, if taken advantage of, will raise human efficiency and remove a serious though often obscure cause of carelessness and discontent.

Atmospheric conditions indoors are usually worse in winter than in summer, especially if the climate be one of extremes. Air stagnancy is the rule rather than the exception, and seldom is effort made to remedy a condition caused by the heating of an already over-dry atmosphere. Little attention has been paid to the immense fuel economies possible by the adoption of a moderate living temperature, a moderate humidity and adequate circulation of air.

In summer, blame for oppressive conditions indoors, when such exist, is often laid to high humidity, regardless of the fact that instant relief is experienced if air movement be secured by mechanical means or by natural ventilation. In winter, a radiator may be used to supply artificial heat; but excessive warmth is demanded because of the unfavorable body reaction to a combination of high temperature and unhealthful dryness.

All is haphazard; there is no pretence at orderly and precise adjustment to insure maximum efficiency and unconsciousness of atmospheric conditions at all times and at all seasons, though this is entirely practicable. Architects and engineers have apparently ignored this avenue for improvement in living conditions. Contrast this with the provision made in a modern theater, where air temperature and humidity are controlled and maintained so that the patron can relax, forget atmospheric conditions, and concentrate his attention on the performance.

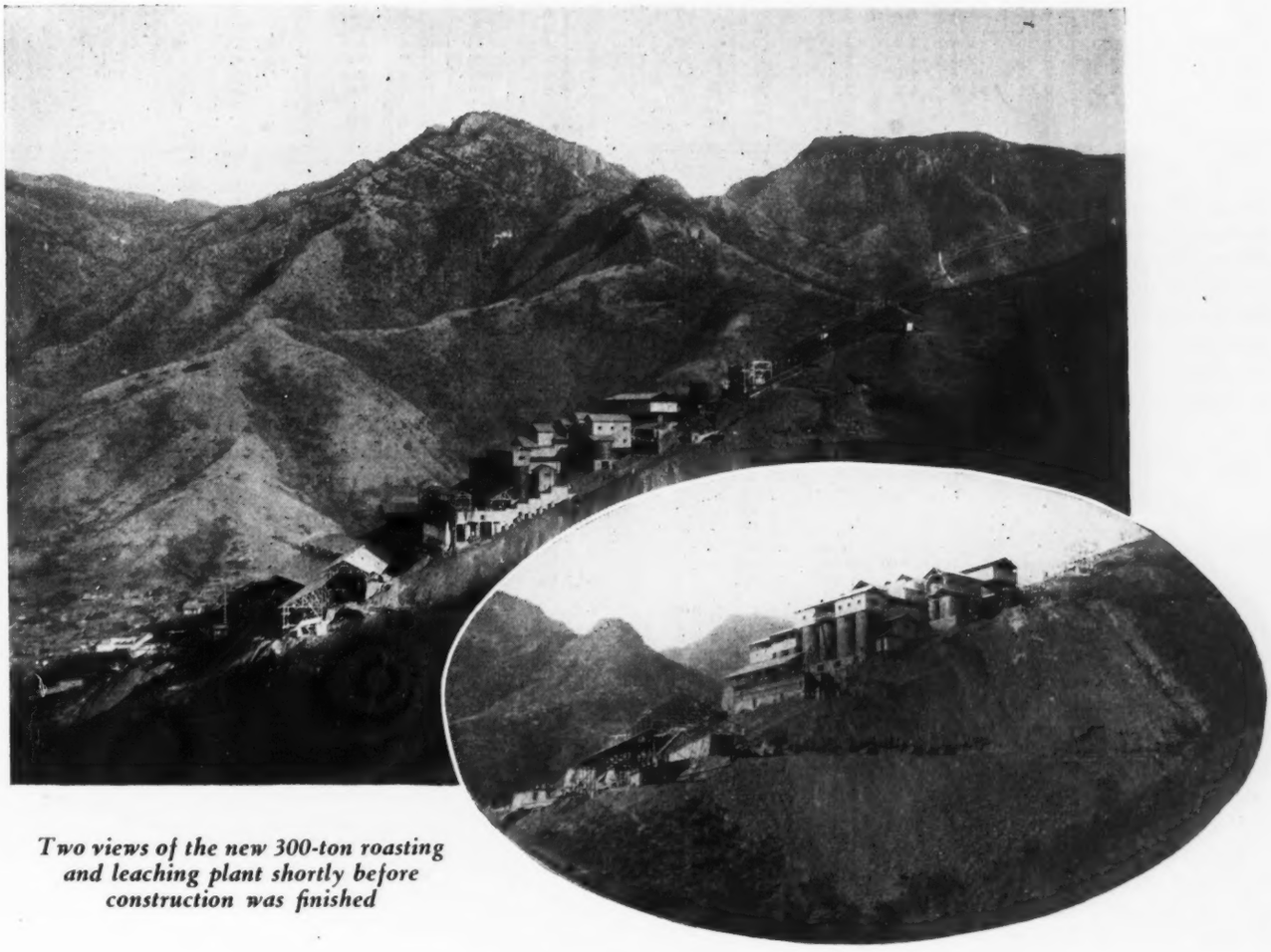
MINERS underground cannot make good records in a badly ventilated working. Mental workers are equally at a disadvantage under equivalent atmospheric conditions indoors. Yet the caterer of amusement appears to be the only pioneer director of industry to take definite steps to prevent physical fatigue and discomfort, to encourage continuous mental alertness. He has found that, despite the expense involved, air conditioning and ample ventilation connote good business.

Little effort seems to have been made to connect decreasing efficiency of mental workers, as the "shift" advances, with atmospheric conditions; to gage and record such conditions in precise and comparable terms, as influencing the output of human beings; or to remedy the condition of atmospheric stagnancy that is the main cause of complaint and lassitude, in summer and in winter. Industry needs to convince architects and constructors of the need for a definite and efficient system of indoor air circulation, which should permit the ejection of air in the summer, creating a definite circulation without disturbance; and convertible in the winter to permit as much interior movement of air as will mitigate the apparently unavoidable conditions caused by excessive dryness and the injudicious application of heat from radiators. The logical ultimate development will involve a system of air conditioning and circulation in each building or group of buildings.

In time, let us hope, it will be realized that present indoor conditions in offices and factories are responsible for much discontent and inefficiency. The mental worker becomes listless and his brain finally ceases to function if means are not taken to correct atmospheric stagnancy. An overheated engine responds in parallel fashion; but apparently only in the latter instance is a connection noted between cause and effect. Showmen appreciate the value of good ventilation and the conditioning of the air breathed by their patrons. Productive industry would benefit if it followed suit.

Salt Roasting and Cyaniding at Achotla, Mexico

PART ONE



Two views of the new 300-ton roasting and leaching plant shortly before construction was finished

By E. R. RICHARDS

Head, Milling Department, Cia. Minera de Peñoles, Monterey, Mexico

A NEW application of the old-time salt roast for treating ores is in use at the Achotla unit, Compañia Minera de Peñoles, S. A., Mexican subsidiary of the American Metal Company. A short history of the development of the process and a description of the milling plant are the subject of this article.

The Suriana mine and the treatment plant make up what is called the Achotla unit, the name being derived from a small village near the mine. Near by is the well-known Reforma mine, the post office of which is Campo Morado, Guerrero, Mexico. The Achotla unit is reached from the rail head at Balsas, Guerrero, by going about 85 km. down the Balsas River in a flat-bottomed river boat to the village of Santo Tomas. A 36-in. gage steam railway, built by the company, connects Santo Tomas with the mill site at Temixco, about 8 km. inland from the river. An aërial tramway, 4.8 km. long, serves to bring ore from the mine to the mill and supplies from the end of the railway to the mine. Hydro-electric power is used and is brought in over a power line, 80 km. long,

Table II—Data from Achotla

Metric Weights. Gold and Silver Assays in

Charge No.	Tons, Calcines	Analysis of Charge					Primary Sulphide, Per Cent	Secondary Sulphide, Per Cent	Charcoal, Per Cent	Salt, Per Cent	Mesh Sulphide	Calcines Assay		Washes, Hours			Loss Weight, Per Cent	Tons Cyanide Tails	Cyanide Wash, Hours
		Pb, Per Cent	Cu, Per Cent	Fe, Per Cent	S, Per Cent	Cl, Per Cent						Au	Ag	Water	Acid	Water			
1 (*a*)	2.7	4.0	0.65	15.6	4.0	3.9	.....	100	2.0	6.0	—20	11.5	603	6	12	6	9.5	2.4	240
2 (*a*)	7.2	3.4	0.85	16.0	4.5	3.4	.....	100	2.0	6.0	—20	11.3	624	6	14	6	10.0	6.5	216
3 (*a*)	9.1	3.7	0.65	16.4	3.8	3.0	.....	100	2.0	6.0	—20	10.5	528	24	24	24	10.0	8.2	240
4	9.1	3.5	0.85	16.4	4.0	2.1	.....	100	2.0	4.0	—20	10.5	528	6	14	6	9.0	8.3	168
5	9.1	3.8	0.50	17.0	3.9	3.6	.....	100	2.0	6.0	—20	10.6	610	6	14	8	9.2	8.3	192
6 (*b*)	10.8	.....	0.75	19.8	3.9	3.1	.....	100	2.0	6.0	—20	10.0	570	6	14	8	8.5	9.9	112
7	11.7	3.2	0.75	19.8	3.9	3.1	.....	100	2.0	6.0	—20	10.2	542	12	36	12	9.0	10.6	178
8	9.4	3.0	0.35	16.2	4.2	3.5	100	00	No	6.0	—14	11.1	580	24	36	12	9.4	8.5	168
9	8.6	3.7	0.37	17.0	5.4	3.4	100	.....	No	6.0	—14	9.8	605	24	48	10	9.0	7.7	168
10	6.3	3.7	0.37	17.5	5.5	3.4	100	.....	No	6.0	—14	11.0	600	24	48	10	9.5	5.7	120
11	7.2	3.5	0.30	17.2	5.6	3.5	None	100	2.0	6.0	—20	9.8	555	13	48	12	9.6	7.5	144
12	8.2	3.0	0.35	15.2	5.5	3.2	100	00	No	6.0	—14	10.5	590	12	40	12	10.0	7.4	96
13	7.9	3.2	0.30	17.0	5.6	3.4	100	00	No	6.0	—14	10.0	575	12	50	12	10.0	7.1	96
14	8.3	.....	.....	.....	.....	.....	50	50	2.0	6.0	—20	11.5	542	18	48	12	9.0	7.6	202
15	6.3	3.0	0.65	15.5	4.6	3.4	50	50	1.7	6.0	—20	9.8	430	10	10	24	9.0	5.7	177
16	8.2	.....	.....	.....	.....	.....	50	.....	.....	6.0	—20	10.2	490	8	40	12	9.0	7.5	192
17	8.1	3.0	0.50	15.0	3.9	3.1	50	50	1.7	6.0	—20	10.8	465	6	52	8	10.0	7.3	192
18	8.3	2.8	0.35	15.3	4.2	3.2	50	50	1.7	6.0	—20	10.0	500	12	24	6	9.4	7.5	192
19	8.3	2.5	0.35	15.4	4.0	3.3	50	50	1.7	6.0	—20	10.0	502	12	24	6	9.0	7.6	168
20	3.9	3.3	0.60	16.0	4.6	2.1	50	50	1.7	4.0	—20	11.5	516	7	12	6	8.5	3.6	168
	159.8											10.4	556						

(*a*) Charges poorly roasted account of inexperienced men. (*b*) Cyanided only 12 hours and discharged.

at 44,000 volts. The power plant is near Toluca. Transportation from the property back to the railroad at Belsas is by muleback, and the cost is about $75 per metric ton from the mine to Belsas, it being practically impossible to transport freight up the river in the boats.

Table I—Typical Laboratory Test on Achotla Ore.

Charge run in experimental blast roasting furnace:

	Kilograms
Sulphide ore, 20 mesh	1.200
Oxidized ore, 14 mesh	11.300
Total ore	12.500
Salt, 14 mesh	0.720
Water	1.200

Analysis:	Gold grams	Silver grams	Iron per cent	Copper per cent	Sulphur per cent	Chlorine per cent
Heads	6.5	475	13.2	1.25	5.3	3.29
Calcines	6.0	444	12.8	1.25	1.7	2.71
Hypo tailing	3.5	104	14.2	0.75	1.0	0.49
Cyanide tailing	0.75	59				

Blast 2 in. on at 11 a.m.

Blast 2 in. off at 2.15 p.m.

Two-inch blast pressure—3 hours 15 minutes.

One thousand grams calcines washed with water and leached with hypo. Water loss, 9 per cent. Hypo tailing as above.

Two hundred and fifty grams hypo tailing washed with 1,500 c.c. acid, 0.3 per cent SO_2, 5 lb. H_2SO_4, and HCl. Two and five-tenths grams loss of weight.

Two hundred grams taken as cyanide head. Add 2 grams Cy., 2 grams lime, and 1,000 c.c. water. On rack for treatment three days. Final tailing as above. Cyanide loss 1½ lb. per ton of ore.

Extraction, per cent:

	Au	Ag
Hypo	50.8	80.2
Cyanide	38.9	8.7
Total	89.7	88.9

The Suriana mine is not an "antigua," but is a comparatively recent development. About sixteen years ago, a single-furnace lead smelter was operated for a time until it was destroyed during the revolutionary troubles of Mexico. Most of the rich lead ore in the mine had been worked up prior to the shutdown, and, as there was little profit in smelting the lean lead ores, the smelter was not rebuilt. A large tonnage of ore had been known to exist for a long time, but no method of treatment was known, so the property lay idle. Cia. Minera de Peñoles, S. A., started to examine the property about five years ago. In the twelve years during which the property was abandoned the openings to the mine were almost obliterated.

Experimental work on the ore was started about four years ago in the laboratory of the company at Monterey. At first, cyanidation was tried, there being no apparent reason, from either the analysis or physical appearance of the oxidized ore, why it could not be cyanided. About 85 per cent of the developed ore is oxidized, and a typical analysis of the ore (gold and silver in grams per metric ton) follows:

Au, gm.	10	CaO, per cent	1.0
Ag, gm.	560	Zn, per cent	0.5
Pb, per cent	3.5	S, per cent	1.2
Cu, per cent	0.1	As, per cent	0.4
Insoluble, per cent	61.0	Sb, per cent	0.5
Fe, per cent	14.5	Mn, per cent	0.6

Cyaniding Raw Ore Impossible

During the study of the ore, a sample was sent to The Dorr Company at Bridgeport, Conn. A microscopic examination of the ore by that company revealed that the silver more than likely existed as an argentum jarocite, which was given the formula $Ag_2O.3Fe_2O_3.4SO_3.6H_2O$. Every variation of cyanide treatment that could be devised was tried on the raw ore and every test failed to give satisfactory recovery of the silver. Even grinding to 700 mesh did not improve silver recovery. Amalgamation, both in hot and cold solution, gave negative results. Concentration and flotation were investigated without results.

Salt roasting in a small blast roasting furnace was then tried, it having been previously demonstrated in a muffle that, if the ore was roasted with salt, the silver was easily soluble in sodium hyposulphite. The blast roaster used was about 10 in. in inside diameter and 12 in. deep. A screen of about 6 mesh was placed two inches from the bottom, and the blast was admitted under this screen. The furnace was ignited by a small fire of wood chips and coal, built on the screen and blown with air until most of the volatile matter was gone from the wood and coal. The ore charge was then placed in the furnace and blown with air at from 1 to 4 in. of water pressure until finished.

Ore from a body of sulphide in the mine was used

10-Ton Experimental Plant

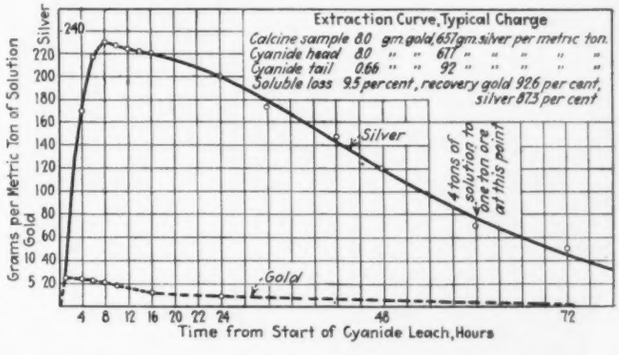
Grams per Ton Unless Otherwise Noted

Cyanide Tail Assay		Contents, Kilos				Indicated Recovery				Bottle Test, Assays				Screen Test, Charge			
		Calcines		Tails		Kilos		Per Cent		Unground		Ground					
Au	Ag	Au	Ag	Au	Ag	Au	Ag	Au	Ag	Au	Ag	Au	Ag	+14	+20	+65	−65
1.55	159	0.031	1.63	0.004	0.33	0.027	1.20	87.1	78.0	1.2	92	1.2	78	3.6	7.6	46.1	42.7
1.50	134	0.081	4.49	0.010	0.87	0.071	3.62	87.7	80.8	1.0	96	1.3	82	10.5	14.2	46.0	29.3
1.55	139	0.096	4.80	0.013	1.14	0.083	3.66	86.5	76.6	0.95	69	0.8	59	5.9	9.4	47.7	37.0
0.85	74	0.096	4.80	0.007	0.61	0.089	4.19	92.8	87.4	.....	.....	.....	.....	13.8	12.4	40.0	33.8
1.15	71	0.096	5.55	0.009	0.59	0.087	4.96	89.6	89.1	0.85	70	0.8	64	11.0	11.0	40.7	33.3
1.05	168	0.108	6.15	0.010	1.67	0.098	4.48	90.7	73.0	1.65	87	1.2	65	10.2	11.1	41.4	37.3
1.25	60	0.119	6.34	0.013	0.64	0.106	5.70	89.2	90.0	1.25	59	1.91	49	9.8	12.0	44.0	34.2
1.45	123	0.104	5.44	0.012	1.04	0.092	4.40	88.5	80.9	1.35	106	1.2	90	11.0	15.0	53.0	21.0
1.35	123	0.084	5.20	0.010	0.95	0.074	4.25	86.9	81.9	1.25	118	1.0	90	11.0	15.0	53.0	21.0
1.30	120	0.070	3.78	0.007	0.68	0.063	3.10	90.0	83.4	1.30	115	1.2	99	11.0	15.0	53.0	21.0
1.25	74	0.071	4.00	0.009	0.56	0.062	3.44	87.4	86.1	1.25	72	1.05	64	10.0	12.0	44.0	34.0
1.20	84	0.086	4.84	0.009	0.62	0.077	4.22	89.6	87.2	1.20	84	1.05	71	12.0	12.0	45.7	30.3
1.30	98	0.079	4.54	0.009	0.70	0.070	3.84	88.6	84.6	1.25	91	1.18	74	12.0	19.0	46.0	23.0
1.00	68	0.095	4.50	0.008	0.52	0.087	3.98	91.8	88.2	0.63	90	0.51	95	10.0	14.8	46.0	29.2
1.05	73	0.062	2.71	0.006	0.41	0.056	2.30	90.4	84.6	1.05	81	1.05	73	6.6	11.8	40.5	41.4
1.06	74	0.083	4.02	0.008	0.56	0.075	3.46	90.4	86.4	1.06	74	0.95	54	.....	.....	.....	.....
1.55	65	0.087	3.77	0.011	0.47	0.076	3.30	87.4	87.5	1.45	64	1.20	50	9.4	14.0	43.1	33.5
1.50	78	0.083	4.15	0.011	0.58	0.072	3.57	86.7	86.0	1.50	72	1.30	60	9.8	17.0	40.8	32.4
1.60	72	0.083	4.16	0.012	0.55	0.071	3.61	85.3	86.8	.....	.....	.....	.....	7.8	14.0	49.2	29.0
2.00	113	0.045	2.01	0.007	0.41	0.038	1.60	84.4	76.9	.....	.....	.....	.....	13.2	14.4	46.2	26.2
		1.659	86.88	0.185	14.00	1.474	72.88	88.8	83.9								

for fuel, the sulphide sulphur in this ore furnishing the heat necessary to effect the roast. A regular program of varying the sulphur was laid out to determine the correct amount of fuel, the percentage of salt being kept at 7 per cent. Table I shows a typical charge, data taken from the notes made at time of the test work. Good results were had almost at once, so far as the roast was concerned. The salt was then reduced to 6.5 per cent, and finally to 6 per cent.

The roast was given a "base-metal" leach with water followed by a leach with hyposulphite. This gave about 75 per cent recovery of the silver and 60 per cent of the gold, which was not enough. The calcines would not cyanide, on account of high consumption of lime and cyanide. It was then discovered that a wash with a solution in water of sulphur dioxide, under 1 per cent in strength, following the water wash, removed the cyanicides and that an extraction of 85 to 87 per cent of the silver and nearly 90 per cent of the gold could be easily obtained with a low cyanide consumption. Tests were repeated many times, both by using the hypo leach and cyaniding combined, and cyaniding alone. An acid wash was made to approximate the acid that would result from passing the gases from the roasting operations through a tower equipped with water sprays. This wash was made to contain around 0.5 per cent by weight of SO_2, four kilos per ton of HCl, and one kilo per ton of H_2SO_4, and used on all the tests except the first few. Careful account of tonnages of washes and solutions used was kept, and consumption of lime and cyanide checked. The result of the testing was that, so far as the laboratory work was concerned, the process was a success.

It was then decided to verify the results on a larger scale, and, to this end, a small plant was built at the mine. A blast roasting furnace, 4x4 ft. square and 6 ft. deep, was built. This was provided with hand-dumping grates. Blast was provided by a fan. Small wooden vats, 4 ft. square and 5 ft. deep, were built for leaching.


Extraction Curve, Typical Charge
Calcine sample 8.0 gm. gold, 65.7 gm. silver per metric ton.
Cyanide head 8.0 " " 61.7 " " " " "
Cyanide tail 0.66 " " 9.2 " " " " "
Soluble loss 9.5 per cent, recovery gold 92.6 per cent, silver 87.3 per cent
Grams per Metric Ton of Solution
Silver
Gold
4 tons of solution to one ton ore at this point
Time from Start of Cyanide Leach, Hours

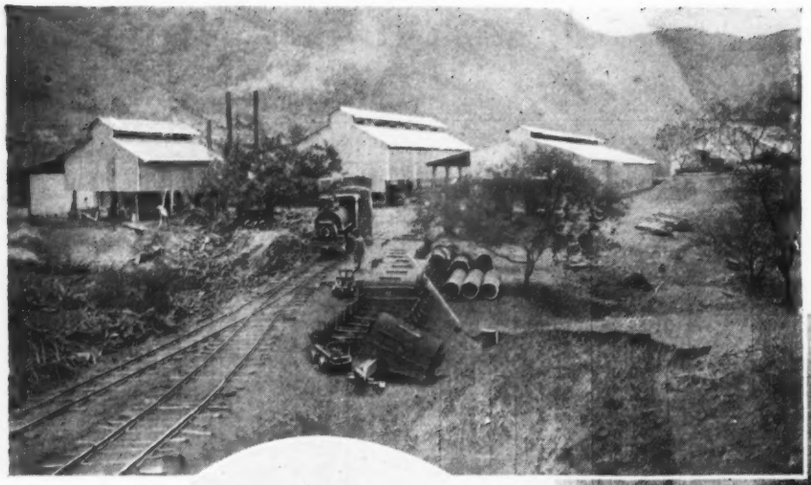
Curve showing assays of effluent solution from cyanide leach

Crushing was done by a pair of small rolls. Screening and mixing the charges were done by hand. A wooden tower, 6 ft. square and 20 ft. high, provided with a spray at the top for admitting water, was used to make acid. Gasoline engines were used as power to drive the rolls, fan, and pumps for returning solutions.

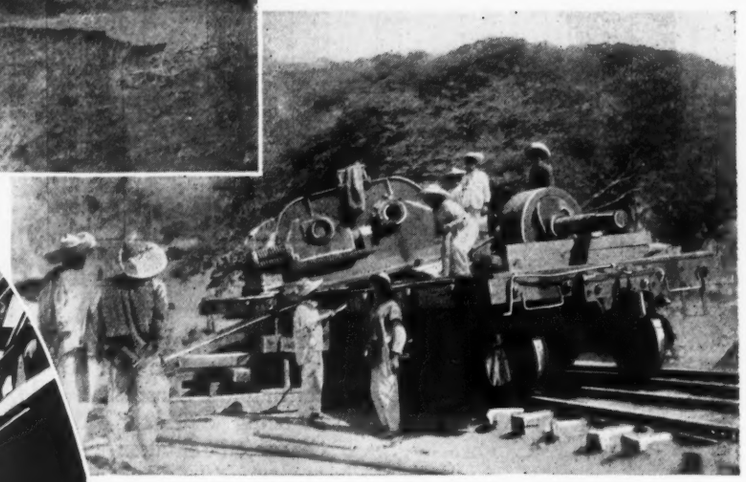
This plant was run on a basis of one to two tons a day for eight or nine months. Considerable trouble was had at the start getting the roast right. Also in learning the importance of making the acid wash thorough enough

Table III—Results of Run in 10-Ton Experimental Plant

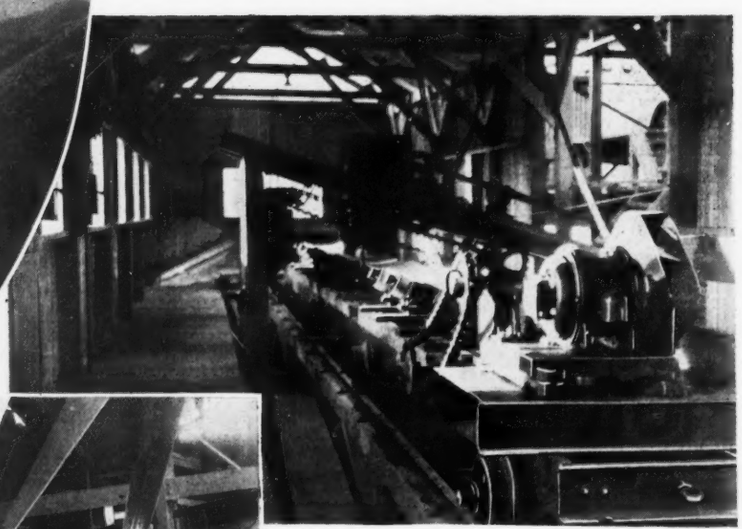
Material	Weight, Kilos	Production: Assay, per Cent								Actual Recovery: Kilos		Actual Recovery: Per Cent	
		Au	Ag	Pb	Cu	Insol.	Fe	CaO	Zn.	Au	Ag	Au	Ag
Cement copper	451.0	0.002	1.48	.....	55.9	.....	.....	.....	.....	0.090	6.67	5.4	7.7
Head zinc box precipitate	51.2	0.710	44.04	36.2	0.8	3.2	1.0	2.3	3.5	0.364	22.55	21.4	25.9
Balance zinc box precipitate	135.4	0.431	25.96	38.6	0.5	1.8	1.1	6.4	9.4	0.584	35.15	35.2	40.4
Zinc, short zinc and cleanings	169.4	0.213	5.23	.....	.....	.....	.....	.....	.....	0.361	8.86	21.8	10.4
Total production	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.409	73.23	84.8	84.4

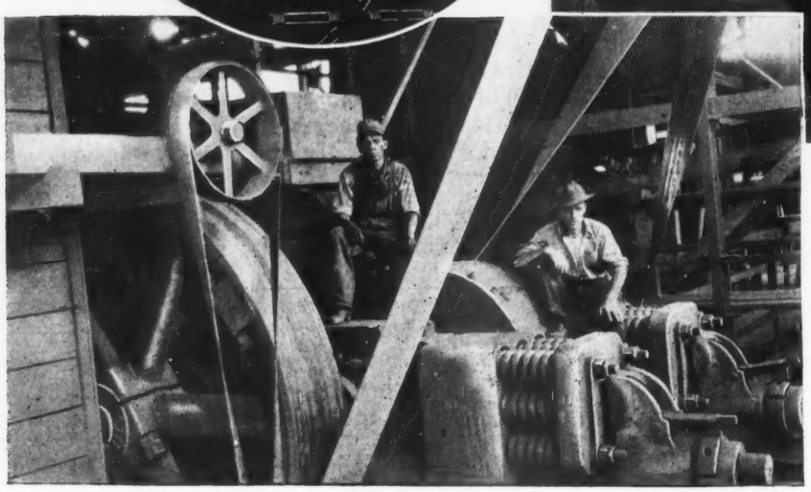


Left—Shops and general warehouse at Temixco, where the mill is situated. Note small locomotive for intra-plant transportation. Below—unloading rolls at Temixco



Left—Angle tower on the aërial tram connecting the mine and the treatment plant





Above—Head of conveyor and shuttle distributor over the ore bins. Left—Large 48x16-in. rolls in the crushing department

properly to prepare the calcines for cyaniding. The final outcome of the campaign were the conclusions that:

1. The results of the laboratory could be duplicated consistently.

2. Cyanide alone gave just as good results as hypo leaching and cyaniding combined.

3. Cyanide consumption was about 1½ lb. per ton of ore.

4. A temperature of 675 deg. C. gave the most satisfactory roast.

5. The roast had to be controlled within rather close limits, or the calcines would not give a satisfactory extraction and cyanide consumption.

6. Finely ground charcoal could be used as fuel to displace most of the sulphide ore with a little better results than when sulphide ore alone was used.

One of the troubles encountered in the test plant was the building up of calcium sulphate in the zinc boxes. This was remedied by adding lime to the pregnant solution and blowing it for a time with compressed air, and filtering before precipitation. Alkalinity in the cyanide effluent had to be kept very low or lead leached out and was deposited in the zinc boxes, rapidly consuming the zinc.

Ten-Ton Test Plant

The work of the small plant left little doubt as to the suitability of the process for treating the ore; but, to remove all doubt as to the process, and to be more sure of the data from which to design a large plant, a second test plant was built, having a capacity of ten tons per day. This was a complete plant, and it was made to parallel operations of a large plant as closely as possible. It embodied:

1. A complete crushing and screening plant.

2. A full-size standard Holt-Dern roasting furnace, half of which was used.

3. Calcine crushing rolls.

4. Leaching vats, 8 ft. diameter by 6 ft. deep.

5. Copper precipitation boxes to remove silver from the first water wash.

6. Zinc boxes for cyanide precipitation.

7. Storage tanks for cyanide solutions.

8. Steam engines and boilers for power.

9. Fan, pumps, and complementary apparatus.

10. Tower for making acid and storage tank for acid.

It was necessary to run this plant only a short period until it had attained its end, after which it was closed down and abandoned, most of the equipment finding its way into the large plant. The plant demonstrated that:

1. Extractions of gold and silver made by the laboratory and smaller test plant could be duplicated.

2. Despite the apparent number of steps in the process, the plant was easy to run.

3. With proper acid washing, cyanide consumption was low.

4. With proper wetting of the charge, before roasting, and proper control of the heat of the roast by regulation of the fuel, results were consistently good.

5. The Holt-Dern furnace was admirably suited to the work.

6. With low protective alkalinity in the cyanide effluent, the lead could be kept out of the precipitate.

7. By agitating the pregnant solution with air and a slight excess of lime, the calcium sulphate could be dropped and settled out in a settling tank and not enter the zinc boxes.

8. A "cut-off" was made by treating a weighted tonnage of ore and cleaning up the plant. The products of the clean-up checked closely to the indicated input, thus showing that the sampling and assaying during the run were correct.

Tables II and III show the results of the test run in the ten-ton plant.

Outline of Design of Present Plant

It was decided to build a plant of 300-ton daily capacity to treat the ore from the mine, and, after a careful survey of the region, the present site was selected as being the most generally satisfactory. It allowed ample storage capacity for tailings, which, under Mexican mining law, must not be allowed to pollute any streams or agricultural lands. The site is not too distant from the mine, is near a water supply, and could be reached from the Balsas River, down which it is necessary to bring all freight.

The process, as indicated by the test work, contained the following steps:

Crushing oxide ore to 8 or 10 mesh. As the moisture in the ore is high, it had to be dried to under 7 per cent moisture before crushing. The sulphide ore had to be ground fine—the finer the better—which entails drying to under 1 per cent moisture.

Mixing, indicated as best done in batches to be sure of the proper amount of fuel.

Roasting, subject to close control by care in the mixing plant. Labor had to be kept to a minimum so as to keep roasting cost low.

Making acid from the roaster gases with which to leach the calcines.

Leaching the calcines with water and acid to remove base metals and cyanicides.

Cyaniding calcines.

Treating of the pregnant solution with lime and filtering to clarify solution properly.

Precipitating, the usual Merrill-Crowe process being indicated.

Crushing salt in a separate plant, necessary because the main crushing plant would be too involved if made to serve to crush salt.

(The plant will be described by Mr. Richards in next week's issue)

Keeley Silver Mines Production Costs

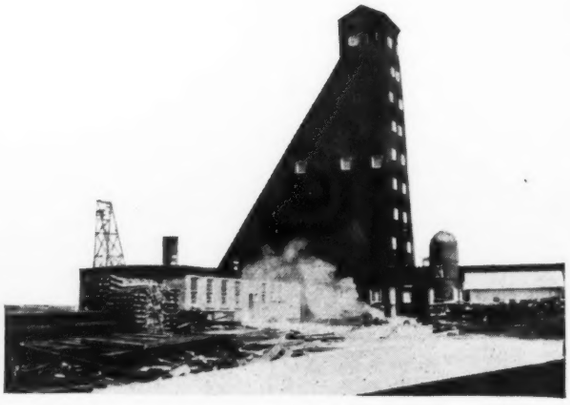
PRODUCTION costs of the Keeley Silver Mines, Ltd., operating in the Cobalt district of Ontario, for the fiscal year ended Feb. 29, 1928, are shown in the following table, which is taken from the company's annual report.

	Per Ton of Ore	Per Ounce of Silver
Development	$4.52	$0.081
Ore extraction	4.59	0.082
Ore sorting	.36	0.006
Milling	1.89	0.034
Shipping and marketing	2.33	0.042
Administration	1.68	0.030
General maintenance	1.99	0.035
Head office expense	.50	0.009
Corporate expense	1.48	0.026
Taxes	.30	0.005
Totals	$19.64	$0.350

The above costs are based on the production of 994,583 oz. of silver from 17,765 tons of ore. Average grade of ore, 34.5 oz. per ton.

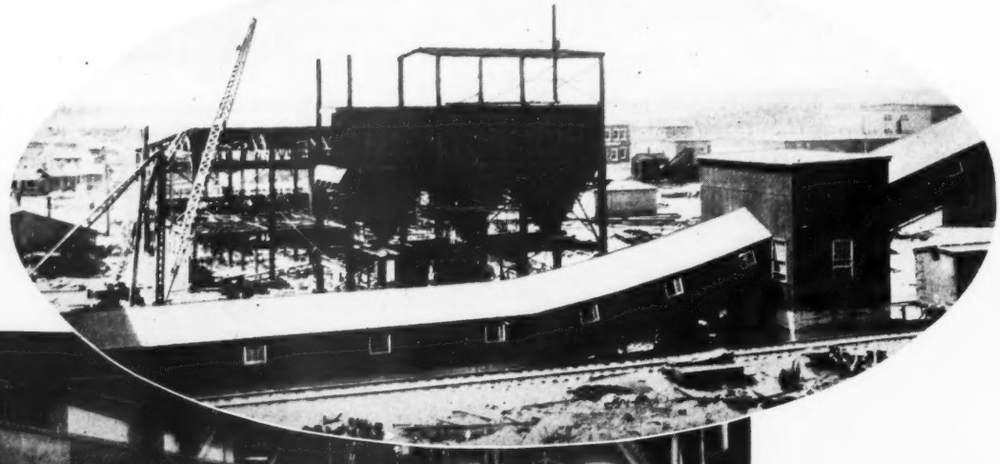
The Noranda

The smelter, at Noranda



No. 3 shaft, the main opening of the mine

In the oval, the 500-ton concentrator now under construction



Left, inside the No. 3 shafthouse

Below, some of the houses of the employees at Noranda. The smelter in the background

Enterprise

PART ONE

The Horne Mine

Stripping an orebody near No. 3 shaft

By A. H. HUBBELL
Associate Editor

NORANDA, the site of the Horne Copper Corporation's mine and smelter, in the Rouyn district of Quebec, is the scene of an established industry today. The visitor who has not followed the successive steps of the development of this new Canadian enterprise will find it hard to realize that less than five years ago the bush reigned here supreme. Then the name "Noranda"—a contraction of "Northern Canada"—meant no more than an inconspicuous company that had recently been formed to exploit the mineral resources of the Pre-Cambrian shield, wherever they might prove attractive. Today it means the highly successful initial venture of Noranda Mines, whose operations, centering about the original Horne discovery, have brought a modern metallurgical plant into existence within the short space of two years.

Close to Noranda—a ten-minute walk away—is the town of Rouyn, the center of the earlier activity of the district. Both towns lie on the shore of Osisko Lake, an attractive sheet of water of irregular shape. Inclosing the lake and the two settlements on its southern edge is the "bush," or forest, which stretches for miles in all directions, save where it is broken by the numerous lakes of the region or where the forest fire has had its way.

Up to a year and a half ago, the traveler into Rouyn had three modes of entry from which to choose: He might go by canoe and portage in the summer, or by dog team and snowshoe in the winter; or else he might take an airplane from Haileybury or other point, which of course was the quickest and most convenient way. Today, he may board a Pullman at Swastika, Ont., on the main line of the Nipissing Central Railway, and, after a 60-mile ride, in the course of which he skirts Kirkland Lake and passes half a dozen bush-surrounded camps, set his foot in Rouyn. Or he may come down from Cochrane, on a branch of the Canadian National Railway, buying his ticket to Noranda.

Rouyn itself serves as a foil for the natural beauty all around it. For relief one looks at the lake near by or at the forest in the distance. Some planning it has had, as its quadrilateral layout witnesses. However, it was built to live in, and its builders had little time for art. Its buildings betray two periods: the older ones, of logs, well pointed with clay, denote the beginnings of the camp before the boomer came to town. They contrast strongly with the more recent flimsier structures. Two hotels furnish fair accommodations.

In full view of Rouyn and not more than half a mile away to the west and north is Noranda. Here is the Horne mine, the chief reason for the camp's existence, with its black shafthouse silhouetted against the sky. A short distance to the left, as one looks from Rouyn, is the group of smelter buildings, and jutting upward from them the lofty reinforced concrete stack,[1] the tallest of its type in North America. Mine and plant are operated by the Horne Copper Corporation, a subsidiary of Noranda Mines. Mr. E. Hibbert is general manager of the local company.

The plant stands about a quarter mile back from the lake, and on the gently sloping ground between the Horne company has laid out a modern townsite, with up-to-date water and sewage systems. After reserving parts of this area for municipal, school, and church requirements, as well as for its own needs, the company threw the rest open for public sale. An open town was preferable to a company town, the management wisely decided. Certain zoning restrictions were imposed. At this sale some fancy prices were realized, one corner lot bringing $5,000, according to report.

Prominent among the buildings that greet the eye as one crosses the short stretch separating Rouyn from Noranda is the brick structure housing the local branch of the Imperial Bank of Canada. The branch bank is indeed the vanguard of civilization in the Dominion.

Close to the lake and beyond the business section of Noranda is springing up what in the course of time should become an attractive residential area. Here the company has erected a guest house and dwellings for some of its executives. All things considered, the town

[1]Described in the *E.&M.J.* of April 21, 1928.

Noranda's finest residential section, on the shore of Osisko Lake. In the left center can be distinguished the guest house, which is also the residence of Mr. Hibbert, the general manager

gives promise for the future. Rouyn, on the other hand, seems to be enjoying its future at the moment.

The Mine

The Horne mine, as stated before, is the principal if not the only reason for the existence of the smelter. Eventually some of the other properties in the district will reach the productive stage and be able to contribute tonnage. Of these the Waite-Montgomery, controlled by Noranda, gives the best and earliest promise. At the present time the Horne is furnishing the requirements of the plant.

To date, by drilling and development work, a considerable tonnage of sulphide ore of commercial grade has been demonstrated to exist within the boundaries of the property. How great the reserves are it is impossible to state. The latest report puts them at 1,198,375 tons above the 300 level as of Jan. 1, 1928, the average grade being 6.73 per cent copper and $5.44 gold.

Fourteen or fifteen orebodies of varying size and grade have been discovered. These deposits are for the most part irregular lenses of mixed sulphides (pyrrhotite, chalcopyrite and pyrite in varying proportions), occurring in the Keewatin volcanics[2] (rhyolite lavas and agglomerates, also andesites), which underlie the area within the Horne boundaries. These volcanics have been cut by intrusives, including a so-called "older" gabbro, a later gabbro (locally called the "newer diabase"), and a syenite porphyry. The older gabbro has been so altered and faulted with the volcanics that its contact with them cannot be followed for any distance. The newer diabase, however, is one of the interesting features of the local geology, being so well defined that it serves as a marker for underground exploration. It occurs as a vertical dike about 85 ft. wide, running almost due north and south through the eastern half of the property from one end of it to the other. It is quite unmineralized. (Another dike, of rock similar to the newer diabase but possibly of earlier origin, approaches the north and south dike from the southwest, but does not join with it.)

No genetic relationship with these intrusives is claimed for the orebodies, although the latter occur in the vicinity of the former. The principal deposits are found at no great distance from the north and south dike and are frequently richest near it. The dikes may have served to dam the solutions carrying the metals. The north and south diabase undoubtedly indicates the existence of a shear zone. Other shear zones have existed also, some near No. 1 shaft, striking about N. 45 deg. E., and others near No. 2 shaft striking east and west.

To visualize the section of the company's property now under active development the reader should picture to himself a north-and-south rectangle 2,500 by 3,000 ft. in dimensions. Approximately in its center is the Main, or No. 3, shaft of the mine, the headframe of which is so prominent on the surface. This shaft is equipped for cage hoisting to the 500 or lowest working level. Below this level it has been sunk to the 975-ft. point, the lowest reached on the property. In no other place, moreover, have the workings gone below the 500 level. East of No. 3 shaft about 175 ft. is the north and south dike, running like a meridian through the property. Thus, to orient himself the reader has a point, centrally located, and a line running north and south. Three hundred feet or so south of No. 3 shaft is No. 1 shaft, now abandoned, which reaches only to the 300 level. Most of the development work done on the property to date has been in the ground about this older shaft. Here five lenticular orebodies, striking in general northeast and dipping steeply, are found on either side of the dike. From these most of the ore extracted to date has come. One of them is a high-grade body (called A-D), running 14 to 17 per cent copper and $4 to $5 in gold, on which No. 1 shaft was sunk. On the first level this is actually in contact with the dike, though it does not appear on the surface. Close by and possibly connected with it is another deposit (B) which has been traced by diamond drill hole to a depth of 720 ft. On the first (140 ft.) level it averages about 8 per cent copper and $6 gold. The chalcopyrite is distributed rather unevenly through the sulphide mass, which is mainly pyrrhotite. About 80 to 100 ft. southwest of the first mentioned deposit and striking approximately parallel with it is a third deposit (C), which has been traced down to the 500 level. It is rather lower in grade than the second body described, although high-grade has been found in some parts of it. Except for the westerly end of the A-D body, these deposits are on the west side of the dike.

On the east side of the dike and about 400 ft. east of the A-D body is a fourth deposit (E), of massive sulphides, averaging about 7 per cent in copper, which has been opened down to the 500 level and traced below it by diamond drill. Possibly this is on the same break as C, but offset by the dike. Between the E orebody and the dike is a body of siliceous fluxing ore, and about 700 ft. west of No. 1 shaft another body of fluxing ore, running higher in gold and lower in copper than ore previously used for flux, has been opened. Both of these are well-mineralized rhyolite breccias. The rhyolite is frequently mineralized, sometimes sufficiently so to be interesting, as in this instance.

In connecting the No. 1 and No. 3 shafts on the first level, what is known as the H orebody was encountered.

[2]According to Dr. H. C. Cooke, Dominion Geological Survey.

This had been found and trenched on the surface, but the values were too low to be of interest. It is the largest mass of sulphide on the property. Where cut on the first level it ran only one-half of 1 per cent copper and $1.50 in gold. When crosscut on the third level, the body was still, in general, of uncommercial grade, although some 20 ft. of fair smelting ore was found on its outer edge. However, the high-grade sulphide recently opened on the 975 level of the No. 3 shaft is thought to be part of the same deposit. This presents interesting possibilities, which, as everybody knows, have already been discounted by the stock market.

South of this ore on the first level, another body (I) was also cut, in which, it is said, rather high gold values in altered andesite were found. No work has been done on it as yet. It is known only on the first level.

One Zinc Deposit

Northwest of the Main, or No. 3, shaft, about 1,100 ft., is the older No. 2 shaft, which goes only to the first level. Near it two interesting sulphide deposits have been discovered. One of these (F) is high in gold and low in copper, with a trace of zinc, and will require milling. Near by and not over 100 ft. northwest of the shaft is a deposit of zinc ore—a disseminated blende averaging about 10 per cent in zinc and occasionally running 20 per cent or more in certain sections. It carries only traces of copper. Oddly, the copper deposits carry only traces of zinc. The tonnage so far indicated is small, being roughly put at 50,000. The deposit is interesting in that it is the only zinc orebody on the property. It is not included in the company's estimates of ore reserves.

Also near the No. 2 shaft and northeast of it is a deposit carrying fair copper and high gold content, but merging into barren pyrrhotite at the east end.

In the northeast corner of the company's property, in the territory east of the dike, scattered high-grade gold mineralizations are found in rhyolite. Nothing that may be termed an ore deposit has been found, however.

Besides the orebodies mentioned, two others have been found. One of these was discovered while constructing a sewer for the townsite and was diamond drilled last summer. The ore is high grade, about 30 ft. of massive chalcopyrite being cut. A drift is being driven toward it on the first level at present. The other, near the primary crushing plant, consisting of bands of high-grade sulphide in rock, was found in constructing a railway track to No. 3 shaft.

In the foregoing sketch of the Horne company's ore deposits has been condensed the information obtained from Mr. H. L. Roscoe, assistant manager and mine superintendent, together with the supporting facts that it was possible to obtain by personal observation in the course of a day spent with Mr. Roscoe, partly underground and partly in the office on the maps. Those desirous of a better understanding of the geology of the district will find it interesting to read the papers by Dr. H. C. Cooke which the Dominion Geological Survey has published. Dr. Cooke is said to have devoted considerable time to this study. A short account, written by Mr. Roscoe, was included in a pamphlet distributed by the company to the visitors of the Empire Mining Congress last September. The company now has two geologists on its staff who are engaged in detailed studies of the formations on the property. Eventually a clearer idea of the manner in which the ore has been deposited will be made possible.

Systematic Exploration

With the exception of certain diamond-drill holes and the downward extension of the No. 3 shaft, work thus far has been confined to the ground between the surface and the 500 level. The 300 level is the scene of greatest activity. Noting the apparent relationship between the meridional diabase dike and the location (not the origin) of the orebodies, the management adopted the plan of driving two north and south exploratory drifts 700 ft. apart with the dike midway between. At hundred-foot intervals along these drifts, horizontal diamond-drill holes were bored east and west, to the dike on the one side and about 450 ft. on the side away from the dike. Thus a strip of ground about 1,600 ft. in width is being systematically explored on this level. This plan has been effective in locating orebodies and affording information. It is to be repeated at a lower level, with the probable modification that the drifts will be driven northeast and southwest, instead of north and south, this because the

Part of the town of Rouyn, as seen across a small bay of Osisko Lake from the Noranda shore. The first plane of the season has just arrived (June 20).

existence of shear zones, striking northeast, has been noted. The new plan will therefore serve more thoroughly to prospect the ground.

Selecting the Mining Method

In selecting the mining method, the management was influenced by the desire to get into production at the earliest possible moment. Any method calling for considerable preparatory work was therefore to be avoided. A typical lens on the property would be about 50 ft. in width, and the ground stands well over this distance. A system of inclined branch raises based on experience with a similar system first developed at the British Columbia Copper Company by Mr. Hibbert and described by him in *E. & M. J.*, March 22, 1913 (also see Peele's "Mining Engineer's Handbook," First Edition, page 527), was finally adopted, with modifications where necessary to suit local conditions. The raises are driven at an angle of 42 deg., which is steep enough to permit the muck to run and yet allow a man to walk. No timbering, save chutes, or shoveling is required. Except for the large H orebody, the largest of the Horne orebodies does not exceed a few hundred feet in length. In most instances a succession of inclined raises are driven along the strike between levels, with loading chutes at the bottoms, and from these similar inclined branch raises are driven at right angles about 35 ft. apart. These branch raises are usually driven about 6 ft. high by 7 ft. wide, and later, after they have been holed through to the level above, are slashed out to the full width of the orebody, and the benches between the inclines are broken down by a combination of underhand and overhand stoping. This method applies where the orebodies do not exceed 50 ft. in width. In the latter circumstance chutes are built 25 ft. apart in a drift driven along the strike, and the inclines are driven at right angles to the strike. The inclines served by two adjoining chutes are joined and later slashed out to a width of 45 ft., but the incline, with its branches served by the third chute along the drift, is left about 7 ft. wide; the series of inclines served by the fourth and fifth chutes are also joined and widened out to 45 ft. in the same manner as the first two. As stoping progresses the wider inclines are opened out into rooms separated by a 30-ft. pillar in which the narrow incline was driven. This narrow incline serves as a pipeway and manway for the two adjoining stopes and later will be used in extracting the pillar. This series of alternating rooms and hollow pillars is extended along the strike for the length of the orebody.

Hoisting the Ore

All ore is hoisted in three-ton cars on cages through No. 3 shaft. Cars are used instead of skips, to permit the segregation of the various grades. Semi-automatic caging equipment is used, and, in general, with respect to caging and the arrangement of tracks in the station and at the collar of the shaft, coal-mining practice is followed, a rather unusual feature for a metal mine. The hoist is a double-drum engine driven by a 250-hp. induction motor. It has a lifting capacity of 12,000 lb. at a speed of 750 ft. per minute. A three-ton storage-battery locomotive hauls the cars from the shaft to the primary crushing plant at the smelter.

In subsequent issues, the Horne smelter and the current metallurgical practice, as well as the results obtained, will be described.

Estonian Oil Shale to Be Exploited by Swedish Firm

A SWEDISH holder of an oil-shale concession in Estonia is reported locally to have obtained a favorable solution of the question of distilling Estonian oil shale on a commercial basis, according to a report from the American consulate at Tallinn, made public by the U. S. Department of Commerce. It is stated that the retorting process of the Swedish firm yields a high percentage of gasoline suitable for automobile fuel.

Estonia contains oil-shale deposits distributed over a total area of 2,500 square kilometers and amounting to over five billion tons. Research has proved that the crude oil from the shale can be refined into gasoline, lubricating oils, impregnating oils, pitch, and asphalt.

In 1919 the Estonian government started exploitation and research, and since 1920 it has granted mining concessions to about ten domestic and five foreign firms, covering a total area of 107,000 hectares. The concessions to foreign firms were awarded on the condition that they should construct distillation plants on their areas. All of the concessionares started experiments with various types of retorts, and extensive laboratory tests were carried out in Estonia and abroad.

The Estonian government itself owns large oil-shale mines and is operating an oil distillery with an annual output of 3,000 to 5,000 tons of crude oil. The Estonian State Oil Shale Industry, which is the official name of the government enterprise, has concentrated its interest primarily on heavy and impregnating oils and asphalt.

The Swedish firm obtained a concession of 10,000 hectares in 1924, and after research work in Sweden established an Estonian company under the name of Estonian Oil Concern, for exploitation of the concession. It constructed an experimental distillery plant with a daily capacity of 300 tons of shale, and put it into operation in May, 1928. The company was primarily interested in gasoline. The oil shale for distillation was purchased from the government mines.

Soon after the work was begun news was circulated in the Estonian press that the firm had solved the shale problem and was producing gasoline of high quality, and that it was planning to constuct a large factory in the near future which would result in considerable exports of gasoline from the country. The company has applied to the authorities for permission to open gasoline filling stations in approximately twenty places in Estonia.

New York & Honduras Rosario Production Data

DATA on productive operations of the New York & Honduras Rosario Mining Company for 1926 and 1927 are compared in the following table:

	1927	1926
Dry tons treated	108,400	110,700
Average content per ton, ounces of silver	21.69	24.70
Average content per ton—ounces of gold	0.0546	0.0558
Total ounces silver produced	2,172,753	2,501,542
Total ounces gold produced	5,684	5,829
Ratio of silver to gold	388:1	440:1
Bars Doré bullion	1,297	1,506
Bullion fineness, silver	979.49	975.54
Bullion fineness, gold	2.55	2.20

Of the above product, 554.02 oz. of silver and 82.821 oz. of gold came from custom ore and melted coins. In 1926, 18,441 oz. silver and 184.5 oz. gold were similarly obtained.

An Unusual Fluorspar Deposit

The fluorspar deposit is situated in a semi-detached elevated area, the summit of which, here seen, is gently rolling farmland

By Martin Schwerin
Elizabethtown, Illinois

FLUORSPAR commonly occurs in vertical or almost vertical fault veins. Those in the southern Illinois district have been thoroughly studied and adequately described. The deposit that is the subject of these notes has received only cursory mention. It is a bedded deposit—a replacement of a bed of limestone which is a member of the geological group in which the well-known veins at Rosiclare occur. It lies in Sections 33 and 34 of Township 11 South, Range 9 East, and is 8 miles northeast of Elizabethtown and 10 miles northeast of the formerly very productive Rosiclare and Fairview mines, at Rosiclare, Ill.

Up to the closing months of the war, only spasmodic efforts to mine this deposit had been made. There had been intermittent production in a small way for more than forty years, during which time the price of fluorspar of fluxing grade had not risen to $6 per ton. In 1918, the New York branch of a London firm of ore and metal merchants, the Messrs. Naylor & Company, acquired the outcrop on the east and south slopes of the mesa-like hill, covering about forty acres between the bedded outcrop contour, halfway down the hill, and the property line at the brow. Since then substantial production has been maintained, the operators enjoying a great advantage in the cost of production over those who are working mines in vertical veins, because of the greater purity of the ore, the higher percentage of shipping product contained, and the entire freedom from the enormous flows of water characteristic of the large producing veins.

The British-owned company, operating as the Spar Mountain Mining Company, began in 1919 to develop and mine the thin faces of ore left by earlier miners, whose faith and purses must have been as small as was the price of their product. These faces, which were not more than $2\frac{1}{2}$ ft. thick, opened out to full drift height when followed. Mining has been prosecuted up to the property line, without sign of discontinuance of ore. The remainder of the deposit, underlying the flat top of the mesa, which is nearly 300 acres in extent, is now being developed under my management.

Certain sporadic deposits, similar in type, lying to the west, in the chain of ridges of which the mesa is a promontory, were studied in 1917.[1] The bedded deposit of the mesa, of which little was then known, is not mentioned in the State Geological Survey's report. A close similarity between it and the others is evident. The quantity of fluorspar minable from the latter, however, and the thinness of their beds, as well as the high silica and large amounts of other impurities contained, rendered them of little economic importance, and detailed study of the whole area was not made.

The Geology of the Deposit

The deposit under discussion is situated in a semi-detached elevated area, the summit of which consists of gently rolling farmland, draining principally into a closed area, determined structurally by a fault that traverses it. The lowest contour of this depression is 50 ft. below the general surface, and the water that drains into the "sink," as it is locally called, disappears down into the fault. The rocks are nearly level sedimentaries, which show on the outer slopes and in the sink. In places they stand out, especially on the steeper eastern and southern hillsides, in abruptly terminating, step-like ledges. From bottom to top they are: the upper part of the Fredonia limestone, the Rosiclare sandstone and the Lower O'Hara limestone members of the Saint Genevieve formation, Meramec group; the Renault and Shetlerville limestones and the Bethel sandstone formations of the Lower Chester group. All are of the Upper Mississippian System. The Peters Creek fault, which extends from its intersection with the Rosiclare veins, 10 miles southwest, to a point 3 miles northeast, passes through the northwest corner of the mesa. This fault has a downthrow on the west of 1,000 ft. It has been prospected at numerous points along its great

[1]Bulletin 41. Illinois State Geological Survey; page 254.

length, but no deposits of economic importance have been found in it. The McWade fault, whose horizontal trace makes an arc of a circle, branches from the Peters Creek fault a mile west, curves eastwardly and northwardly through the mesa, and rejoins the Peters Creek fault at a point due north of the sink. Its throw has a probable maximum of 20 ft. downward on the east. The fault-filling is a low-grade, high-silica material, which is of non-commercial grade and is not amenable to profitable concentration.

Limestone Replaced by Fluorite

Fluorspar outcrops around two sides of the hill. It is in the very top of the Fredonia member of the Saint Genevieve limestone and below the Rosiclare sandstone, from which it is separated by a bed of shale two, three, or more feet thick. The fluorite has replaced the limestone, faithfully preserving its mineralogically differing laminæ. These now appear as alternating light and dark bands, from one-half to one inch wide. The light bands, usually white, colorless, or faintly yellowish, consist of crystals of pure fluorite, whose free faces, measuring up to three-eighths of an inch, project into voids of slight thickness, but frequently of great horizontal extent, paralleling the bands; or else the crystals extend across, and, closing the gap, interlock loosely with similar crystals growing out of the band opposite. The ore almost invariably breaks by separation of these interlocking crystals.

Darker bands, reddish brown, gray, or, less commonly, purplish in color, are of finer grained, lower-grade, higher silica material, with texture resembling fine-grained limestone. The silica of such ore—that is to say of all light and dark bands together—is well below the maximum metallurgical limit. The sheet voids appear to have resulted from decrease of volume attendant upon the process of replacement in which calcium carbonate reacted with the fluorine-bearing mineralizing solution to form calcium fluoride. In further support of this assumption is the fact that where massive fluorite was found occupying the whole thickness of the former limestone bed, without trace of the banding after the laminæ, the shale above was dropped several inches onto the top of the fluorite. Putting it another way: where replacement is incomplete and the silica grains of the fine-grained bands supplied nuclei on which crystal growth began from fixed positions in zones in multiple, whatever shrinkage resulted from the replacement process was, considering it for the whole bed as the unit, divided into as many sheets or voids as there were imperfectly replaced siliceous bands. Where all of the laminæ of the limestone were of such high purity that their silica differences were negligible, thus doing away with any most favored points of attachment, and no zonal nuclei were afforded from which to start outward the rhythmic crystal growth of the bands, the result was massive fluorspar and the shrinkage shows all in one place—namely, at the top. The letting down of the slate has been followed in some instances by the growth of beautiful crystal groups characteristic of vugs and cavity linings. In such places sheets and fragments of slate are wholly included in fluorspar.

The limestone bed is not replaced throughout its whole area in the hill. The outer boundaries of the deposit make broad bulges and re-entering curves. At the upper surface the deposit has the plane-like regularity of the shale which lies on top of it, whereas the under surface undulates, giving thicknesses up to 12 ft. of high-grade spar and at the margins closing upon the roof. The average thickness over economic stoping areas is approximately 5 ft. An outline of the deposit resembles in plan that assumed by a body of water when a brook that flows through tortuous, narrow, nearly level marshes has been dammed back by a high tide at its estuary and the waters spread over the flats, covering the lower ground, the margins being determined by the irregularly rising slopes between which the water is confined.

Massive fluorite, without banding, from floor to roof, is found. Elsewhere partly replaced tongues or partings of the limestone appear. Unnoticed at first, these, with their high silica and low calcium fluoride, get thicker and thicker as the margin is approached, and the spar above, or both above and below, gets thinner and thinner and finally disappears. The partings are always very much more siliceous than the normal limestone. Such mineralogical and chemical variations have played a controlling part in the position, size, and shape of the deposit.

Numerous barren, vertical fissures, up to an inch wide, run in all directions, without conformity into a system. Where they cut the fluorspar deposit they show only as breaks vertically across the bed, and where they are in the limestone they are often filled with calcite or limonitic, calcareous, incoherent material or are quite tight and void of filling. Along the course of two of these some minor replacement of the walls has occurred and narrow "runs" of ore are found. These runs present the greatest irregularities of deposition and the most heterogeneous mixture of residues. Handsome crystal groups and massive fluorite of high purity are found imbedded in clay, with fragments of partly replaced siliceous limestone and slabs of shale lying brokenly at all angles. The walls are most irregular and grotesquely cavernous, and the débris of spar and waste terminates abruptly and cleanly against the jagged, shapelessly dissolved limestone.

Sequence of Minerals

Petrographic study of the ore and the less mineralized partings which divide the ore shows that the first effect of the thermo-aqueous action was the introduction of silica. C. W. Greenland, in a petrographic report made to me, says:

"The metasomatic nature is shown by the excellent preservation by the fluorite of the original granularity of the limestone. It is also evident that the original limestone was of varying composition, some layers being more siliceous and ferruginous than others. This is shown by the presence of quartz in well-shaped crystals, in some cases showing enlargements, limonite, and siderite.

"It seems clear that the uprising solutions, which may have been gaseous, first reorganized the existing silica in the rock and perhaps also contributed some of it. This was followed by the replacement of the limestone by fluorite. Even the bands which appear to be limestone contain as much as 60 to 70 per cent of fluorite."

The vein filling of the McWade fault shows clearly the deposition of silica and fluorite of a first generation. This was followed by a reopening of the vein and the introduction of fluorite only into the interstitial spaces, now the veinlets and patchy areas. This sequence, with respect to these two minerals, is the opposite of that at Rosiclare.[2] There no fluorspar deposits are found replacing sedimentary beds. Here in Section 34 no

[2]L. W. Currier; Bulletin 41, Illinois State Geological Survey; page 258.

bodies of commercial spar are found in the faults. This contrasting difference of occurrence is suggestive that causative phenomena and conditions must have been unlike in these two closely associated areas of the same geological group. An explanation is here offered of the unusual features of the bedded deposit.

It is accepted that the fluorspar deposits of the district owe their origin to intrusives, of which evidence exists in the dikes and sills. The Rosiclare fault vein and the McWade fault are branches of or minor faults terminating in the major Peters Creek fault, which is itself not single, but consists of several roughly parallel faults. That the ascending mineralizing solutions first entering the veins at Rosiclare were unlike those first entering the McWade fault vein is evident from a consideration of the mineral sequence. That the predominating mineral and the permanently fixed limitations in the character of each vein were determined by such respective first solutions is deducible from the facts. Solutions that rose through the material of the fault, and, having deposited one or more of their solutes and having reacted with the material there while conditions of permeability and porosity of the mass and its fragmentary components were most favorable, fixed the high silica of the vein in the McWade fault so that subsequent reopening and entry of solutions, predominantly fluoritic, found the new conditions there unsuitable for any profound rearrangement of the existing proportions of the minerals. A discussion of conditions under which deposition of fluorspar, alone and with silica, takes place is given by Currier. The veinlets and ribbon bands of pure fluorite between the fragments of earlier high-silica vein material are ample evidence that such later fluorite-depositing solutions entered the McWade fault. Vertical banding of pure fluorite is also found, paralleling the walls.

The extensive bed of rich fluorspar lies under a bed of shale that swells, sloughs, and slacks on exposure to air. The later solutions rising in the McWade fault met greatest resistance at the thick drag barrier where the fault cuts the shale. Since solvent action was lacking on the constituents of the shale, but active on the limestone beneath it, while pressure was maintained by the barrier, the replacement of the limestone is readily understandable. Throughout the whole course of the McWade fault it is marked by orebodies contiguous to it, over a distance of more than two miles. At no place is there now to be seen an intersection of the fault with an orebody. At the Cave-in-Rock mine, which lies to the west, the fault must pass through or very close to the old stope; but the mine is abandoned and under water, and the relations cannot be studied. On Spar Mountain ground the intervention of the property line has halted development in ore at a considerable distance from the fault, so that full demonstration of the hypothesis advanced must await mining development under the mesa.

Nine distinct cross-beds may be seen in this exposure of the calcareous Rosiclare sandstone, lying immediately over the shale which covers the ore. This is evidence of the marginal position of the formation.

The deposition of ore in sedimentary beds covered by impervious blankets of rock is well established. Rico, Colo., is a familiar example. At Rico, however, the replacement has occurred in close proximity to the veins in every instance. The only great horizontal dimension of the orebodies there is that along the strike of the vein. The dimension at a right angle to the strike is relatively small, so that the orebody is only an enlargement of the vein at its top. Here, in the bedded deposit of fluorspar, metasomatic replacement has proceeded outward from the vein source, if the conclusions reached as to their source are sound, for thousands of feet. Regardless of the source, the deposit is an almost ideal example of the process. The preservation of bands in the limestone is so perfect that we may count the years, with their seasonal freshets pouring their burden of silt into the sea. And is it too great a strain on deductive reasoning to say that where the dark bands of siliceous material are wide a wet year was experienced by the land fauna and flora of that remote time, and where such bands are thin they underwent a drought? For more recent times Dr. Douglas, of the University of Arizona, makes the rings of tree growth give up their story of years and cycles of years of precipitation; and he is able to correlate them by comparison of ring growths over a wide geographical range, and so actually to assign definite dates to events on this continent centuries past. Variation in thickness in the same vertical section, of the dark, siliceous bands of fluorspar, might also be

explained by changes in topography of near-by areas and changes in depth of water over the accumulating sediments.

The migration of solvents to great distances through such rock as a relatively pure limestone presents no difficulty. One portion of the deposit is known to extend from a point near the McWade fault to a point half a mile east and formerly extended further out over what is now the valley. How much has been removed by erosive agencies that shaped the present topography we have no means of knowing. An inspection of the deposit, particularly the detail of texture, makes it evident that not only did the process of metasomatism here find favorable conditions, but that even a neutral liquid, as water, would, without any pressure, advance mechanically through the voids between the bands of mineral. The sealing-off effect of replacement solutions in building up a relatively impervious zone, thereby circumscribing their activities, has created a difficulty to comprehension in some instances where deposits have been ascribed to such an origin. No such difficulty is found here, where free passages in a chemically stable mineral are built up, *pari passu,* so that unimpeded progress, through unlimited time, was permitted the flow of solution as long as it continued to rise in the fault or found a suitable reactant with which to combine.

Vertical Fissures Studied

As a possible source of the uprising solutions the numerous vertical fissures and crevices other than the McWade fault have been studied. None of them has any displacement whatever. The limestones are rocks whose behavior under stress, where near the surface, is governed by the very low elastic limit of the material. The arching and doming of the area in such brittle strata caused numerous thickly spaced ruptures without other movement than a slight gaping apart of the walls.

These breaks all offset on their strike. That they also offset in depth, particularly when passing through an unconformity, is extremely probable. Such considerations are not favorable to their having been the channels communicating directly with deep-seated intrusives. To so regard them would be far-fetched in view of the presence, adjacent to the bedding deposit, of a vein with positive though small throw. Two of the fissures that cut the deposit, with widely differing strikes, contain fluorspar; but all of the others, as well as all their intersections, are barren. In no instance is there an isolated body of bedded spar associated with one of the fissures. Were they the channels up which the solutions rose to replace the limestone bed it seems almost certain that such isolated deposits would be found. Their independence, and separation, one orebody distinct from the other, would have been the rule had the sources of their supply been distinct and separate, as are the fissures.

One of the cracks or fissures which cuts the easterly part of the deposit was prospected 50 ft. below, and was found to contain a little fluorspar with later barite. It strikes northeast, and because of the filling may be called a vein. In the horizon of the bedded deposit this vein is accompanied by a narrow "run" of fluorspar and unconsolidated débris for a hundred feet from the point where it emerges from the margin of the bedded deposit. This vein was several times exposed in the course of development in the bedded deposit, and in each place the fluorspar bed was distinctly broken apart at the vein and the break unhealed. Small amounts of barite are in places deposited on the walls of the break. Also, the bedded deposit thinned out and diminished to an unworkable thickness in the normal manner, determined by the high silica partings, and showed no enlargement or greater volume of replacement ore in proximity to the vein, where the latter emerged from the bedded deposit, as would be expected if the vein were older than the ore deposit in the limestone bed. It seems clear that the vein is younger.

The readjustment of the rocks of the region after their invasion by intrusives and their profound faulting must have been accompanied by numerous ruptures such as those described. That the process was continued throughout a long period, coextensive at least with the time required by the intrusive to attain physico-chemical quiescence or stability, is probable.

In the heterogeneous mixture of materials composing the "run" of ore which accompanies the vein where it extends beyond the margin of the bedded deposit, and within the same limestone horizon, is found barite deposited as a coating on crystals of fluorite. The fluorite found in the vein evidently marks the final stages of mineralization from solutions entering by way of the bedded deposit. Barite, the last mineral deposited, in conformity with its known occurrences elsewhere, must have come in with solutions migrating through the sediments, along the latest ruptures, subsequent to and in no way related to the fluorine-bearing mineralizers given off by the intrusives.

The shape of the deposit and its dimensions, horizontally, as well as its thickness, have been determined solely by the varying mineralogical and chemical composition of the several partings (not the laminæ) of the limestone and by the overlying blanket of shale. Where there was uniformity in chemical composition of a bed of high purity, complete replacement resulted, to the very uttermost limits of such portions of the limestone bed. When the feathering edge of a high-silica parting, found in the middle of a drift's height with a full breast of spar, gradually thickens while the fluorspar thins, the edge of the deposit is being approached, and turning the drift toward the better side brings it back into thicker spar. Development becomes a sort of subterranean navigation where not the compass but the pocket tape is to the miner what the sounding lead is to the mariner. Before knowledge of the fact was gained, rectangular development was followed and drifts sometimes were in thin spar. But when the habit of the deposit became better known it was found that it was not necessary to do dead work in development. Continuity of ore became a demonstrated fact, and previous notions of detached orebodies, like peas on a vine or plums in a pudding, were proved erroneous. Thereafter directions of drift headings were determined solely by the criteria here stated. The various lobes and bays on the sides of the deposit could all be developed by drifts in ore.

Cross-bedding Evidence of Marginal Position

The upper part of the Fredonia, in which the fluorspar bed is found, was a shallow marine or marginal sediment and the siliceous and calcareous materials of its several partings differ in their proportions. Cross-bedding in the calcareous Rosiclare sandstone, shown in the second illustration, immediately over the shale which covers the ore, is additional evidence of its marginal position. For a sedimentary rock the changes in the limestone are unusually abrupt.

In summarizing the data the following may be stated:

Deposits of economic importance in this district, whether of the vein type or the bedded type, are associated with the lesser faults of the great fault systems. The lesser faults are also probably later than the great faults.

The replaced limestone bedded deposit described is confined to areas of the purer partings. Solutions responsible for their deposition rose through a fault of slight throw, and not through the cracks or fissures of no displacement.

It is apparent that the shale blanket over the bedded deposit influenced deposition in the limestone just beneath by permitting maintenance of hydrostatic head for expenditures in horizontal directions.

The distance through which metasomatic replacement will extend may be unlimited when pressure head is maintained by impervious and inert rocks; when chemical reaction is simple and complete, and when the products occupy less volume than the unreplaced rock, resulting in voids, so that solutions may continue to pass through. These are the conditions here. When such is the fact, limestone of high purity is a veritable sponge for fluorine-bearing solutions.

The Ore-Magmatic Theory

My observations of the deposit described, covering a period of nine years, fail to disclose evidence that "magmatic injection, ascending through small fissures under pressure, actually lifted up and separated the layers of the blockading shale bed. . . ."[3] On the contrary, there is no instance of a bowing up of the shale or sandstone roof of the deposit. The top of the deposit is remarkably flat, uniform, and undisturbed. All of the irregularities are in the under-surface of the ore. The varying thickness of the sheet of ore is attributable in all instances to bulges and trough-like depressions in the unreplaced or partly replaced limestone under the ore.

A characteristic and almost invariable accompaniment of the common, prevailing type of ore, the banded material, is the parting of siliceous limestone separating an upper from a lower blanket of ore. Sometimes the upper, sometimes the lower, is the thicker. The actual and the relative widths change, gradually and uniformly over hundreds of feet, until both disappear and the parting between has thickened until only it remains. Over hundreds of feet this parting, only an inch or two thick, is as undisturbed and as constant as any slate parting or "bone" in a coal seam. Could this be, if the foot, or two or three feet, of banded ore above it and below it had been intruded magma? Would not the parting have been shattered to bits?

Conditions represented by the sketch of Fig. 5 on Page 731 in Spurr's paper are found where either the whole section of ore is one mass of fluorite, all of the original limestone at that point having been dissolved and removed, or where deposition has occurred in a case or "run," resulting from earlier aqueous action. The residues, consisting of transported clay, fragments of limestone, and slabs of shale, were present when solutions entered and deposited fluorite. Fragments of limestone were either wholly or in part replaced and large crystals developed in the clay. Shale was unaffected.

The irregular bottom on which the typical banded ore lies is incompletely replaced limestone. In places this "near-ore" extends to a depth of 6 ft. and often closely resembles unaltered limestone. Surely that material is not a magmatic injection!

The vein, up which Spurr believes the "ore magma" to have come, has no displacement—not even an inch. There is no igneous dike, sill, or intrusion within 6 miles; therefore the likelihood of that vein having been the channel of a magma or even for the gaseous emanations from one is extremely remote. Moreover, that vein crosses the principal axis of the orebody and intersects but one lobe of it.

And, finally, microscopic study of thin sections of the banded ore and the imperfectly replaced parting that is so often found dividing the ore into an upper and lower sheet reveal the original texture of the limestone preserved by the fluorite.

[3] "The Kentucky-Illinois Ore-Magmatic District." J. E. Spurr, *Engineering and Mining Journal*, Oct. 30-Nov. 6, 1926.

Asphalt Mining Industry in Sicily Shows Gains

SICILY'S asphalt deposits are recognized as important, as is the necessity of working them efficiently to lessen purchases abroad of heavy mineral oils, residue from the distillation of resin and tar, and various crude mineral oils, states Vice-Consul Alexander P. Cruger, at Messina, in a report made public by the U. S. Department of Commerce.

The mines in the Province of Ragusa are exploited by five companies, the largest of which is the Societa A.B.C.D., with headquarters at Rome. Before the war these mines were exporting considerable quantities of asphalt in blocks, powder, and mastic, not only to Italy proper but also to foreign countries. Production of asphalt reached 135,000 metric tons in 1912; the annual output during the quinquennial period 1910-14, inclusive, averaged 117,000 tons.

In the war period, production declined rapidly and came to a virtual standstill. In 1917 the output amounted to 2,000 tons. In 1918, however, the A.B.C.D. company set up at Ragusa a large plant for the distillation of asphalt to produce fuel and lubricating oils. Asphalt containing less than 6 per cent of bitumen and the residue of other processes are usually employed for distilling purposes.

In 1918 there was extracted 17,000 tons of asphalt, all of which was distilled. In the following year production rose to 46,563 tons, of which 25,000 tons was distilled. No data are available indicating the amount of oil derived from this distillation, but it is known that 1,300 tons of crude oil was exported in 1920 and 2,000 in 1921, and that 123,000 tons of asphalt was produced in the two years. In 1922 the production of the mineral declined to 25,670 tons.

Beginning with 1923, production was increased in all the mines. It amounted to 95,000 tons in that year, rising to 129,600 in 1924, 200,000 in 1925, and 225,000 in 1926. During these years increasingly larger quantities of oil were produced—less than 200 tons in 1922, 1,960 in 1923, 2,400 in 1924, 3,400 in 1925, and 3,000 in 1926.

In 1927 the generally unsettled conditions of business reacted on the industry and reduced the production of asphalt by about 100,000 tons from the 1926 figure. At the same time there was a greater production of mineral oils, amounting to 3,500 tons. These crude oils are sent by tank cars or ships to the company's refinery at Trastevere, a suburb of Rome.

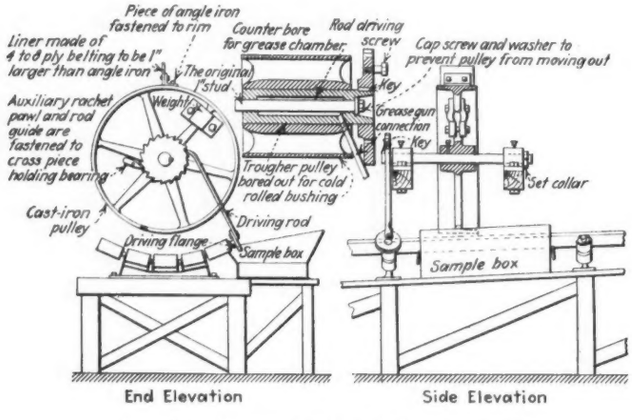
USEFUL OPERATING IDEAS

Sampler for Belt Conveyor

By Charles Labbe

IDEA No. 1

OFTEN, after a belt conveyor has been installed, an automatic sampler is desired. To install it at the head or the end near a chute is not always feasible. The sampler shown in the accompanying sketch can be placed anywhere on the conveyor. It consists of the drive which is taken from the outside pulley of the trougher, a driving rod, and a ratchet wheel on a shaft carrying a weighted pulley to which is attached the sample cutter. The outside pulley of the trougher is modified by the addition of a flange, a common 1- to


Piece of angle iron fastened to rim
Counter-bore for grease chamber
Rod driving screw
Liner made of 4 to 6 ply belting to be 1" larger than angle iron
Cap screw and washer to prevent pulley from moving out
The original 1" stud
Key
Auxiliary ratchet pawl and rod guide are fastened to cross piece holding bearing
Weight
Grease gun connection
Key
Trougher pulley bored out for cold rolled bushing
Set collar
Cast-iron pulley
Driving rod
Driving flange
Sample box
Sample box
End Elevation
Side Elevation

Details of sampler for belt conveyor

1½-in. pipe flange with three tapped holes on three different circles so as to give three different stroke lengths.

A piece of $1\frac{3}{16}$-in. shafting or larger carries the ratchet wheel on two pillow bearings. The wheel is from 8 to 12 in. in diameter and is keyed on the shaft. A common pulley 2 to 3 ft. in diameter is also keyed on the same shaft. On the rim of the pulley is riveted, or bolted, a piece of 3- or 4-in. angle iron set at a slight angle with the rim and lined on the side with a piece of 4- to 6-ply belting projecting at least 1 in. beyond the angle iron. The counterweight is clamped to a spoke or to the inside of the rim at about one-sixth of the circumference behind the projecting piece of angle iron. A rod of about ¾-in. material, one end beveled to shape and the other end provided with a hole drilled for the driving screw, is used as indicated to operate the ratchet wheel from the driving flange. A ratchet pawl is placed as shown in the sketch to prevent return and to restrict rotation to one direction.

While the conveyor is in motion, at each revolution of the outside trougher the ratchet wheel is advanced one or more teeth. When the counterweight passes the top center, its weight carries the angle piece across the feed on the belt and pushes a sample into the receptacle at the side. The number of cuts can be varied by setting the screw in any of the three holes or by changing the diameter of the ratchet wheel. The size of the sample can be varied by changing the width of the sample cutter. The pulley is set so that the outside circle described by the outer edge of the sample cutter barely touches the conveyor belt. The curve of the belt at the trougher will give the approximate diameter of the pulley, a somewhat smaller diameter being preferable to a larger one. To insure a positive drive for the trougher it may be advisable to set it ¼ to ⅜ in. higher than its neighbors.

Overload Signal for Bowl Classifier

By E. G. Howe

IDEA No. 2

THE EFFICIENCY of a grinding plant depends to a great extent on classifier capacity and the greatest circulating load that it is possible to deliver, without lost time caused by overloaded and stuck classifiers. To attain this ideal condition I have developed at the mill of La Mazata y Anexas, S. A. (at Etzatlan, Jalisco, Mexico), where we use a bowl classifier, a device that seems to solve the problem of continuous operation, with the maximum circulating load to the mills.

This device consists of a float, placed behind the bowl, and in the compartment above the reciprocating rakes. The float is at the extremity of a rod which actuates an arrow of sufficient size to be seen throughout the mill. The arrow is pivoted off center in such proportion that a vertical movement of the float of one inch will give a travel of four inches at the point of the arrow, which moves over a sector of a circle painted red on the bottom half and white above.

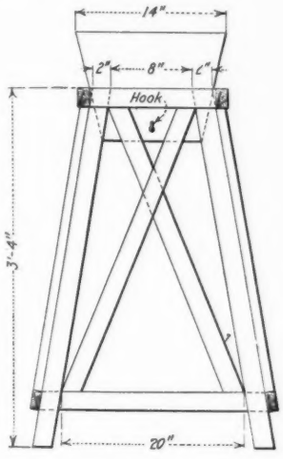
In operation, all dilution to the classifier is uniform, particularly the back-wash, the valve of which is provided with a stop. As the pulp is fed to the bowl and passes into the reciprocating rake compartment and thence to overflow, it travels countercurrent to the back-wash. Any variation of feed to the classifier will retard or accelerate the flow of the back-wash. This causes a change of the level of the water in the reciprocating rake compartment, thereby actuating the arrow through the float. An overload will raise the water level and the float, causing the arrow to point down, or into the red. When the load is lightened, the back-wash has freer egress to the bowl, and the level in the reciprocating rake compartment is lowered. The arrow then moves up into the white area, denoting a lack of feed.

After making dilution adjustments and placing the float at the proper level, the operator increases or lessens feed as the arrow indicates. Since applying this device at the plant, we have a continuous full load on the grinding mills and no lost time from stuck classifiers. Our screen analyses of classifier overflow vary only 1 per cent on the minus-200 size.

An Ore-Sack Holder

IDEA No. 4

THE sack holder shown in the illustration has been found satisfactory for sacking ore at a Georgia mine. It consists of a hopper which fits into the top of a frame, to which it is held securely by reason of its shape. The sack is suspended by a hook on each of the four sides of the hopper, the bottom just touching the floor. When it is full it is freed from the hooks by turning them down and lifting the frame over the sack. The frame is light and can be made of 1x2-in. or 1x3-in. material. Any carpenter can make it in an hour or two. Advantages claimed for this expedient are: One man can bag material alone; the hopper permits the use of sacks having different sizes of openings; and any size of sack may be used if the legs are made adjustable.



Device for holding an ore sack

Disposing of Power Plant Ashes

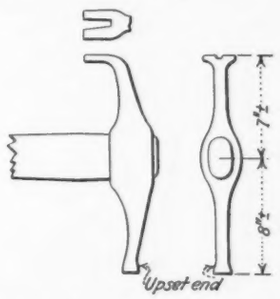
IDEA No. 5

FOR disposing of power plant ashes at a mine in the Middle West a scheme was adopted which involved the use of an inclined 8-in. iron trough set in the concrete floor of a tunnel connected with the ash pits. The ashes were scraped into this trough from the ash pit and then washed to the foot of a bucket elevator by turning water in at the upper end. The elevator had a 14-in. rubber belt, with a 12-in. bucket. The ashes were elevated vertically about 50 ft. and emptied into another trough, from which they were sluiced with water. The second trough was a 12-in. water pipe split in two and inclined about 1½ in. per foot. This expedient saved the labor of several men on three shifts.

A Tool for Pulling Railroad Spikes

IDEA No. 6

A TOOL that is useful for driving and pulling light spikes of the size used on industrial railroad tracks may be made from a pick as indicated in the accompanying drawing, according to *Engineering News-Record*. This tool, for which the name "pickhammer" has been suggested, was used in laying and relaying track for concrete cars at the Grizzly Creek division dam, now being built in California for the Feather River Power Company. The pickhammer can be made from used picks as well as from new ones, provided the points have not been worn down too far. It is undesirable to make the width of the V in the claw very large, lest the strength limit of the handle be exceeded. Keeping the size of the V small discourages the use of the tool for pulling standard-size railroad spikes.



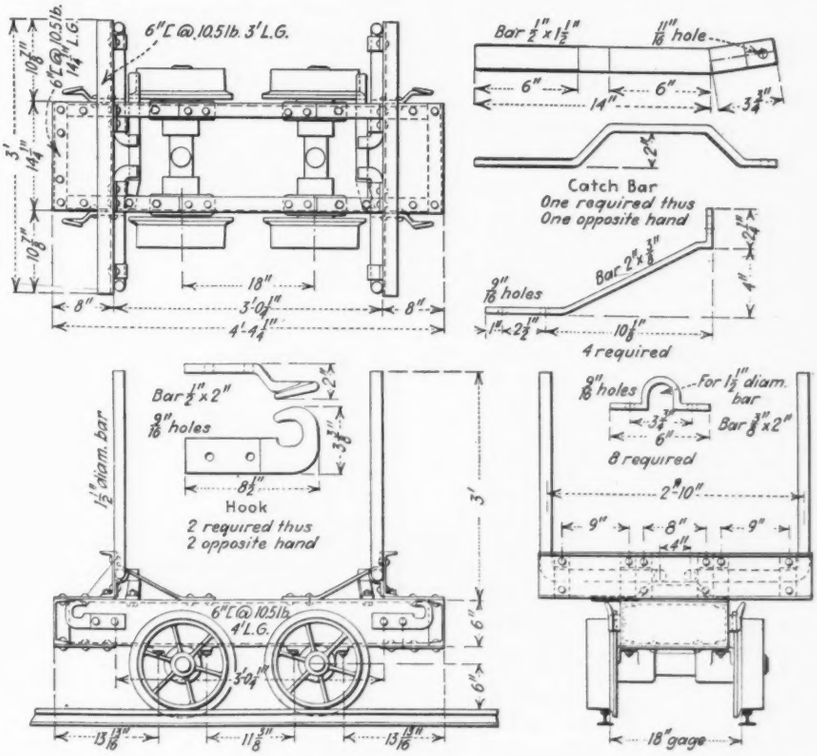
A converted pick for pulling light railroad spikes

Old Dominion Timber Truck

By E. H. Oneal

IDEA No. 7

THE SMALL timber truck, used by the Old Dominion Company and shown on the accompanying drawing, possesses some features that are worthy of attention. It is of the usual construction, consisting of channel frame and roller bearing wheels or axle housings. The feature of particular interest is probably the method of design and manner of operating the folding arms or posts. The catch bar, hinged at one end, fits under the bent end of the posts to hold them in a vertical position and is moved out from under these ends to allow the posts to drop.



At right, construction details of Old Dominion timber truck

COMMENT AND CRITICISM

Canada Claims Steadily Growing Mining Industry

THE EDITOR:

Sir—I read with interest Mr. C. M. Campbell's article on "Pre-Cambrian Misconceptions." Although I agree with him in the main, and most of his statements are perfectly justified, his arguments are weak and in many places give a totally wrong impression of the situation. An article of this nature in a paper of such scope may do more harm than good. Instead of staying within his subject of correcting any misconceptions that might be held, he wanders off on other channels on which he is not quite so safe. I have no wish to revive debates witnessed in Canadian mining circles some time ago, but a few words might not be amiss.

As all mining men and most laymen know, statements appearing in many brokerage house organs, and even in reputable financial and other papers, must be, and apparently are, discounted to a large extent. If such were not the case the North would be full of men drawn by such statements as "inconceivable wealth in minerals," and "every acre yielding forth riches." It is quite possible even to this day to camp in many sections of the North without being unduly bothered by one's neighbors, and this in areas of so-called favorable prospecting; as witness the present article under discussion, it is possible for engineers of standing to have papers of opinion published in mining papers as long as they stay within bounds. It is impossible for editors to verify all news.

After going into some detail to explain that many parts of the Pre-Cambrian are different both from a standpoint of rock types and economic minerals, Mr. Campbell holds that proof of the worth of the Pre-Cambrian as a whole, if proof there be, should be found in the relatively small areas of Pre-Cambrian of southern Ontario and Quebec, where no large mining operations are being carried on. In view of the fact that the geology is quite different in the two parts, the force of such argument is not quite apparent. In fact, other than in a general way I have yet to note any great similarity between any two different areas where mines are operating or hope to operate in the Pre-Cambrian. Almost all the various areas open for exploration present new problems to solve. The suggestion that engineers, instead of traveling farther afield, spend their time nearer home, where Pre-Cambrian rocks exist, is inane. For all that, they might do worse than give this southern area some attention.

Mr. Campbell states that after 75 years' work by able geologists the main features of the Pre-Cambrian are pretty well outlined. As far as distribution of rock types is concerned I will grant this, but as far as economic geology is concerned much remains to be learned, even by able geologists. Five years ago the presence of copper-zinc ores in northwestern Quebec was not suspected, even though this area had been prospected for some time and geological maps and reports issued. I can well remember well-known engineers going over the present Noranda ground, where heavy gossan was exposed in trenches, and because only low gold values were indicated in this gossan it was given almost no attention. The drilling which picked up copper-gold-zinc ores on this property was done only after the drilling of several quartz bodies some distance away had failed to give any encouragement. Their presence had not been previously suspected, and even when found they were looked upon more as a freak of nature than anything else, until some time later when other similar ores were found.

There is also contained in the article the following statement: "Instead of being hardly scratched it is doubtful if there exists anywhere, outside of arid districts where the hills are bare, any area that is so thoroughly scratched as the great mass of the Canadian Pre-Cambrian." This statement verges on the foolish. I grant that the great mass of the Pre-Cambrian has been fairly well traveled over along waterways, but it certainly has not been thoroughly prospected. Mr. Campbell touches on one of the secrets of lack of success when he states that prospectors follow the waterways and prospect from their canoes. They are now beginning to realize that all deposits are not conveniently placed along the shore line awaiting their coming. I do not agree with Mr. Campbell that is is possible to obtain a knowledge of the country from the canoe. Rock outcrops in the favorable areas of the Pre-Cambrian are relatively scarce, even along waterways, and intensive search on the ground is necessary for even outcropping deposits to be found. To take an example: The Red Lake area was the scene of considerable activity quite a few years ago, and nothing of importance was found. The area was mapped geologically in some detail and yet nothing of interest was noted. A discovery which showed promise was then made, and work was concentrated on this for some time, the remainder of the area being rather quiet, although still being prospected. It was only after an intensive exploration campaign set in that the camp showed signs of becoming other than a one-mine camp, and assumed its present promising condition. The same story is true of nearly all camps in the North.

I am willing to admit that the results of intensive exploration in northwestern Quebec have on the whole been disappointing. Outside of the major discoveries made before this intensive campaign commenced, and others in the immediate vicinity made later, nothing of any particular interest has been found. However, Nature cannot be blamed for all this failure. On the strength of known discoveries there began an orgy of promotion. Companies were formed holding obviously barren ground, and what little of the money that did get spent on exploration was of course wasted. Nature was blamed for not placing orebodies promiscuously throughout the rocks. All these mistakes were placed to the credit—or rather discredit—of the mining industry. A sound industry is thus given the appearance of being unsound. Granting no more discoveries, the present ones warrant the camp a place in mining affairs for some years to come.

Mr. Campbell mentions a well-known exploration company operating for five years with no success. We may not be thinking of the same case, but I can recall a company which fits into his details, which, through lack of co-ordination among the higher-ups, let several promising things slip through its hands, and on account of this eventually threw up the sponge. But why hold this up to discredit of the Pre-Cambrian? Such cases are not unusual. The mistakes of man are blamed on Nature.

From reading the article one gathers the impression that we who have faith in the Pre-Cambrian are mentally deficient; that the wise ones have realized the uselessness of wasting further time in chasing ghosts and have left for other climes; that for all statements issued to the contrary, we must realize that only a very small part of the Pre-Cambrian is favorable for the occurrence of economic deposits, and that in these areas again deposits are relatively scarce. Even taking all this into consideration there is no reason to be discouraged. We do not claim to be able to supply the world with metallics in the future,

but we do claim a not unimportant and steadily growing mining industry. As far as the future of this industry is concerned I regard the Canadian Shield as being one of the most promising areas for exploration in the world, and for some years to come, as present known deposits are depleted, new deposits will be found to take their place, and, I hope, with some to spare.

GEORGE H. SALTON.

Kingston, Ontario.

Phe Phi Pho Phum

THE EDITOR:

Sir—Your editorial "The Shift Boss—Is He a College Graduate," in the issue of Aug. 18, is summer reading, sure enough, for the super of a few years' experience in practical mining work. Conditions change, and today the dissemination of knowledge is a function of organized society, and facilities for acquiring knowledge of every sort are so easily available that only those who prefer to remain ignorant or who are congenitally moronic need remain in the class of common laborers.

Probably the most efficient shift bosses of the era now passing were those natural miners, the Cousin Jack Cornishmen, who knew ore when they saw it, and who knew how to get it out. The verbal reactions of such practical underground men to the implied suggestion that a shift boss who is a college graduate would have an edge on the other fellows may be imagined, but cannot be here reproduced, because of legal prohibitions and postal regulations.

The collegiate complex is a malady to be avoided, even though one realizes the great advantage of technical training and of higher learning in practically all vocations. A really clever sporting editor on a great metropolitan daily once ran at the head of his sports page the legend

"Of Collegians
"By Collegians
"For Collegians"

The caption appeared once only. It evoked derision and mirth, and the editor was ridiculed for months. Finally the mere mention of collegians caused him to froth at the mouth—for froth could be had in those days.

To stress too much the value of bookishness is to become lopsided. Brains without balance bring no distinction, and deserve none. The consensus of opinion among captains of industry is that many men are coddled through college who would, if properly directed, have joined the ranks of the really skilled artisans, of which the world never has enough.

The shift boss who works his way through college by slinging hash and peeling spuds may climb to the heights of success. One who gets a degree "custom made" may carry into regions where it is of no use the complex he is likely to develop.

Y. R. U.

Gowanus, Mont.

An Effect of Irresponsible Journalism

THE EDITOR:

Sir—Our attention has been called to your editorial of July 28 referring to the Corona Mining Company. We beg to inclose a copy of a letter we have written to the Corona Mining Company today, and also a copy of our report on a concentration test made by us on ore from the Corona mine. You will notice that no reference is made in this report to aluminum. The sentence to which you objected, "There is over 44 feet of 16 per cent aluminum in sight," has been added to our report without our knowledge and absolutely without our consent.

Furthermore, we wish to state that we are not the technical advisers of the Corona Mining Company and never have been. We have made several assays for the company and one concentration test, and had no other connection with it.

The article on cyanidation for the small operator was not written for *Underground*. It was written some years ago and copied by *Underground*. Your comment on this article we feel is unjust, as the article is based on many years' experience. The series consisted of about ten articles covering the subject in full for the information of the small operator, and *Underground* copied only one of them.

TECHOW & DAVIS,
By W. Techow.

Sacramento, Calif.

(Copy)

Concentration test on copper ore for Mr. W. B. Barkley, 611 Mills Building, San Francisco.

Ore used, 1,000 grams.

Concentrates made, 38 grams.

Tailings, 962 grams.

Assay of ore, 2.25 per cent copper; 5.4 oz. silver per ton; $10.40 gold per ton.

Assay of concentrates, 12.6 per cent copper; 44.8 oz. silver per ton; $142.0 gold per ton.

Assay of tailings, 1.7 per cent copper; 3.7 oz. silver per ton; $5.20 gold per ton.

The total extraction of copper is 21.2 per cent. Extraction of silver 31.5 per cent. Extraction of gold 51.9 per cent. It is quite evident that this ore cannot be treated by gravity concentration, as the copper minerals float very readily. It is ideal ore for oil flotation, and we are certain that a high percentage of extraction together with a marketable grade of concentrates can easily be obtained.

(Signed) WALTER TECHOW.

(Copy)

Corona Mining Company,
611 Mills Building,
San Francisco, Cal.

Gentlemen:

Our attention has been called to your advertisement in the June number of *Underground*. This advertisement pretends to be a copy of a report on a concentration test we made for a Mr. Barkley on ore from the Corona mine. The copy is incorrect, as the words "There is over 44 feet of 16 per cent aluminum in sight" have been added to it. Our report contained no reference to aluminum at all. You are hereby notified that you will be held responsible for any damage done to us on account of publication of a falsified report.

Truly Yours,
TECHOW & DAVIS.
By Walter Techow.

[The incident draws attention to the evils of irresponsibility, if not unscrupulousness, in the conduct of a publication that claims to supply technical information. *Engineering and Mining Journal* apologizes to Messrs. Techow & Davis for assuming that they were responsible for the contents of the report as published and for the inadequateness of the article on cyanidation, which, as Dr. Techow explains, was merely an unacknowledged abstract from a series.—EDITOR.]

Competition Is an Inherent Characteristic of Endeavor

THE EDITOR:

Sir—In the address before the American Bar Association Dr. George Otis Smith speaks of the evils of competition and the effects that the anti-monopoly laws have had on conservation. He suggests that the repeal or revision of these would go a long way toward remedying things.

That the evils of competition can thus be abolished is doubtful. The competitive evil is inherent in something more fundamental than our laws—it is inherent in our ideas of property and in our fundamental political ideas. To change the laws without changing these fundamental ideas will only cause a change in the place and in the form of the evil.

To understand the history of any period, one must understand the nature of the dominant ideas of that period. In our day the idea of property is dominant in the economic field. The idea of majority rule is dominant in the political field. These have given our economic and political history its characteristic features.

Such fundamental political and economic ideas are competitive in their nature and make for contentiousness. Our system of property permits ownership of natural resources without limit. This means that some may own to the exclusion of others. Thus, men who serve their own interests do so at the expense of others. If they don't seek possession, they may be deprived of opportunity, and thus are made to pay tribute to those who do possess them. It becomes a struggle for mastery.

This idea of property, being of a contentious nature and dominant, makes all other ideas contentious. Ownership of our natural resources should be considered as a trust. The same process and incentives are at work in the eco-

nomic field—the smaller will tend to unite into larger groups. This will not stop until all are lined up against one another in two large groups. Everywhere—in city, county, state, and nation—one will generally find all interests lined up behind two rival banking interests. During the Great War the nations of the earth, following the same process, lined up into two groups. What the foregoing shows is this:

"Anti-monopoly" laws which help keep in the field several rival groups, will, when repealed, give us instead two rival groups in the nation. These may give way to two world-wide groups. Repealing these laws will not stop competition. Repealing only shifts the struggle to larger groups and gives it some other form. The evils of competition between the large groups are not likely to be less than those arising from competition between the small groups.

The real cause of the competitive evil lies in our ideas of property. A change in these is needed. More real good, in my opinion, can be accomplished at the present time by spreading the idea or doctrine that the owners of our natural resources are trustees who cannot do as they please with them, but are morally obligated to administer them in the interests of the whole people. When this doctrine is thoroughly accepted, a law embodying its sense and purpose can be passed—a law that will be worth while. WM. CROCKER.

Prescott, Ariz.

Amateur Assaying as a Cause of Unwarranted Optimism

THE EDITOR:

Sir—In your issues of June 30 and July 31, 1928, comments are made on the "white metal" and tin excitement in southern Oregon. Our laboratory has had some experience with similar materials from the State of Washington, which might be of interest. In this case, also, both ore said to contain white metal and tin ore were submitted, but the owners of this ore were unquestionably entirely honest. These men were practical miners, who probably have spent their entire lives prospecting and mining and who incidentally had picked up some very elementary information on metallurgy and assaying. Comparatively little information was volunteered on the ore containing the so-called "white metal," but considerable work had been done on the tin ore.

As has been the experience in Oregon, these men also had sent samples of their ore to official assayers, with negative results, and, as seemed to have been the case in Oregon, the assayers and mining engineers did not take the trouble to explain to them wherein their own crude methods of assaying might have been at fault, but evidently simply contented themselves with accusing them of ignorance or fraud. Obviously, such treatment could do nothing but instill distrust, and the net result was that the miners continued to waste their time and money on their own crude experiments. Their method of determining the presence of tin in this ore was to melt the ore with suitable flux in a crucible and to add lead for the purpose of carrying down the tin. Then they established the presence of tin by dissolving some of this button into nitric acid and diluting with water, which treatment gave white precipitate similar to the stannic acid produced when tin is so treated. They also determined the increase of weight of the lead when used repeatedly, and from this increase they made an estimate of the amount of tin in the material smelted. The laboratory analysis of the ore itself failed to show the presence of tin, but the lead button, said to have been produced in their little furnace, did actually contain 1 or 2 per cent tin.

On inquiring as to the source of their lead, it was found that this was not pure lead, but was scrap lead which might have been contaminated with solder, and they were therefore asked to repeat their tests using lead which they knew contained no tin. On analyzing the resultant lead button, no tin was found, but appreciable amounts of arsenic and sulphur. The arsenic and sulphur obviously account for the increase of weight of the lead button, and, on dissolving some of this material in nitric acid, the lead sulphide was obviously oxidized to sulphate. On diluting this solution with water, a precipitate of lead sulphate was naturally obtained, which could easily have been taken for stannic acid. It is therefore obvious from the foregoing that the increase in weight of the specimen which had been ascribed to tin was only caused by the combination of lead with the sulphur and arsenic in the ore, and that the white precipitate which the miners mistook for stannic acid was only lead sulphate.

To convince these men, who were obviously honest and who had spent so much of their time and money—thus in vain—that they actually had been misled by their own experiments, it was suggested to them that they repeat their tests in all details except that they substitute for their tin ore some sulphide-bearing ore which they knew did not contain tin. They would then find that this ore would cause the same increase of weight in the lead button and the same white precipitate as their own reputed tin ore had done.

Probably similar explanations could be made for the results obtained in connection with the so-called "white metal." I am wondering whether it would not be better if chemists and engineers who are asked by miners and prospectors to give opinions on their ore were to make some effort to show the men where they are being misled. It is evident that the course which had been pursued so far by the profession has only caused dissatisfaction and distrust, and has not stopped needless waste of money and efforts, which evidently still is going on in these districts. EVALD ANDERSON.

Western Precipitation Company,
Los Angeles.

The "Fair" Sex Takes a Name in Vain

THE EDITOR:

Sir—While at home this morning I was called on the telephone, and a woman (I do not use the word "lady") stated that Mr. (the name sounded like "Allen"), of *Engineering and Mining Journal,* had given them my name as one who would be interested in mining stock.

I told her to tell her principals that it was an insult to my intelligence being called up on a matter of this kind, and to state further that I had died from the shock, and that therefore it was useless to talk to a dead man regarding matters of this kind. She laughed and stated: "You are certainly very frank." I replied that if she were a man, in all probability I would use language which I thought she was accustomed to hear, but that it was not my practice to use such language when addressing a woman. She laughed again and stated, "Well, I guess you are not interested," and rang off. Unfortunately I did not lead her on, as I might have done, in order to learn just whom she represented.

I was rather curious to know how this woman obtained my telephone number, and immediately called up the office and was told that this woman had asked for my telephone number, claiming that she was a friend of my daughter. Thinking this might be so, they let down the bars and gave her the number.

I believe if this letter is published, it might have its proper effect and eventually put a stop to their scheming tactics. EXECUTIVE.

New York, N. Y.

Tin Developments in Bolivia

THE EDITOR:

Sir—Permit me to call attention to some inaccuracies in an article headed "Development of Tin Properties Continues in Bolivia Despite Low Price," appearing on p. 226 of your issue of Aug. 11.

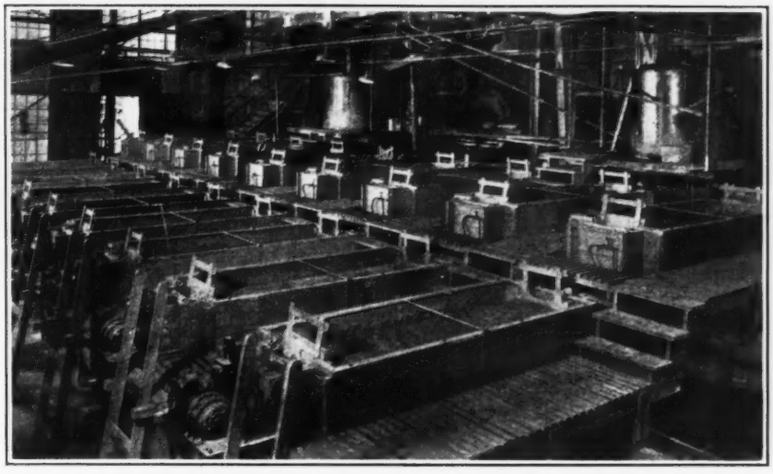
The Vila Apacheta mine is under option to the Tin Corporation, Ltd. The mine is being examined and developed entirely by this corporation, which has no connection with Metal & Mining Shares, Inc. The Tin Corporation, Ltd., also has under option the Centenario tin placer, at Uncia. Drilling is now being done by this corporation. The article erroneously states that Yuba Dredging, of California, is drilling the property. CHAS. V. BOB.

New York, N. Y.

INDUSTRIAL PROGRESS

Speed Reducers Used on Flotation Cells in Silver King Mill

By H. D. Keiser
Assistant Editor



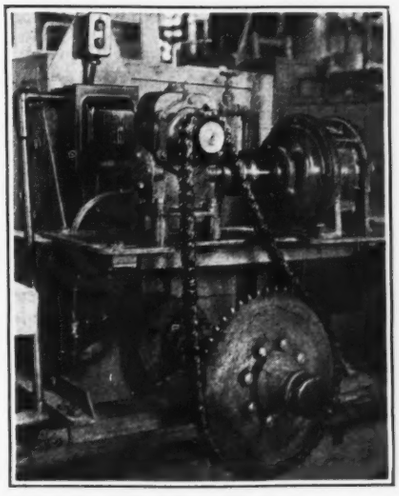
A section of the flotation department in the mill of the Silver Coalition Mines Company, showing application of speed reduction units to flotation machines.

THE first application of a speed-reduction unit of the Foote type to the MacIntosh flotation machine was made recently with complete success in the remodeled mill of the Silver King Coalition Mines Company, situated near Park City, Utah. Twenty-eight MacIntosh cells are employed in the mill, and by adopting this type of drive to them, the use of cumbersome reduction mechanism, such as belts, line shafts, or open gears, has been avoided, and efficient accessible installation obtained.

Each machine is driven by an individual 1-hp. 1,200-r.p.m. General Electric motor, connected directly through a flexible coupling to a type No. 3 HGS IXL Foote wormgear speed reducer. The Foote unit has a speed reduction ratio of 20 to 1, and two sprockets with a reduction ratio of 4 to 1 transmit to the rotor of the MacIntosh machine a speed of 15 r.p.m. The smaller sprocket has 12 teeth, and the other 48. A No. 27 Baldwin 1-in. detachable steel roller chain connects the two sprockets.

Construction of the Foote speed-reduction unit includes Timken roller bearings on the worm-gear shaft, and ball and radial thrust bearings on the worm shaft. The worm gears are made of chilled and cast bronze to give exceptional strength and wearing qualities. Carbonized, hardened, ground, and polished nickel-steel worms are used, and a special form of tooth design, employing a high helix angle, results in a minimum of friction and unusually high mechanical efficiency. All gears run in oil. The unit is notable for its compact design and neat appearance.

Flotation machine equipped with individual motor and gear speed reduction drive.



New Fan-Cooled Motors

A NEW LINE of totally inclosed fan-cooled motors, 1 to 50 hp., has been developed by Allis-Chalmers Manufacturing Company. All active parts, such as stator core, stator winding, and the rotor, are completely inclosed, preventing contact of outside air, dirt, dust, fumes, and moisture, with the interior or active parts. Heat is carried away by a sufficient volume of cooling air forced around and across those parts which conduct the heat from the interior to the outer surfaces. A circumferential air jacket controls the path of cooling air. Solid cast-iron bearing housings are attached to stator end heads with machined fit, which, with grease-packed bearings, form a perfect end closure.

Internal parts of the motor are readily accessible by removal of housings. A unique feature is that in many ratings this totally inclosed design delivers the same horsepower output as is obtained from the same frame in the standard open rating. Temperature rise is within 50 deg. C. measured by the resistance method. The design provides for a most sturdy construction with a minimum number of parts.

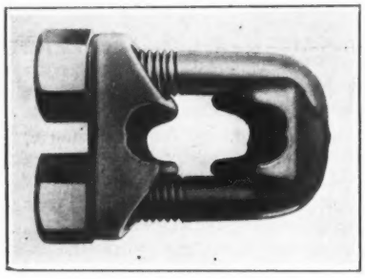
Preformed Wire Rope Tested

COMPARISON of so-called preformed wire rope with rope of ordinary lay was the objective of a test recently conducted in Germany by government officials in co-operation with Felten & Guilleaume, a prominent industrial concern of that country, according to the American Cable Company. This test was conducted on a factory elevator, operating automatically without an attendant. A counter installed at the top of the shaft recorded the number of trips made. The results were as follows:

On the elevator carrying over 3,000 lb. of dead weight, a preformed wire rope made nearly 10,000 round trips without a single break or fracture, whereas the ordinary twisted type of wire rope accomplished the same work only after a fracture of eight wires in the rope attached to the cage and of seventeen wires in the rope working on the counterweight. In the second test the preformed wire rope made a total of 18,600 round trips and sustained only one single broken wire, whereas the ordinary rope subjected to the same test sustained 44 fractures in the rope attached to the cage and 190 fractures in the rope working on the counterweight.

Cable Clip Has Grooved Jaws

A cable clip with a considerably larger holding surface than usual has been put into production, in a full range of sizes, by the Eureka Metal Products Corporation, of North East, Pa. It is a patented clip, which, according to tests, has shown its ability to carry three



An improved cable clip

times the maximum load of an ordinary clip and gives equally good results both on wire rope and messenger strand, this without distortion of the cable. The large surfaces of both the top and bottom plates are grooved for the lay of the cable, so that the latter is not gripped by the U-bolt. The clip has only four parts. Any size wrench can be used to tighten it up.

Improved Steel Castings Object of Research

STEEL castings have become so essential in modern industry that a group of prominent companies engaged in making them have recently got together in an effort to improve their product as well as their methods of manufacture. This group realizes the importance of organized research. To effect this and to co-operate more closely with users of their castings they have organized an association known as the Steel Castings Development Bureau. This will have its headquarters in the Stock Exchange Building in Philadelphia.

The bureau comprises companies manufacturing steel by open hearth, converter, and electric-furnace processes, each having its own particular application in the field of steel-castings production. The following firms are active members:

Atlantic Steel Casting Company, Chester, Pa.
Crucible Steel Casting Company, Lansdowne, Pa.
Deemer Steel Casting Company, Newcastle, Del.
Dodge Steel Company, Tacony, Pa.
Empire Steel Casting Company, Reading, Pa.
Eagan-Johnson Steel & Iron Company, Crum Lynne, Pa.
Pennsylvania Electro Steel Casting Company, Hamburg, Pa.
Riverside Steel Casting Company, Newark, N. J.
Treadwell Engineering Company, Easton, Pa.

It will be the objective of the bureau to produce a superior quality of steel castings, and, by the application of science, to amplify the results of current practice. Practical research work is already in progress on improvements in the process of manufacture, greater efficiency, and better castings; on possibilities in use of alloy-steel castings; and heat treatment, resulting in improvement of physical properties and general betterment of quality.

Arrangements are also being made whereby users or probable users of steel castings can consult with the technical advisors of the bureau on any problems relating to the use or application of castings.

PATENTS

DRILL SHARPENER. Nos. 1,680,248 and 1,680,249. Aug. 7, 1928. Frank M. Lee, assignor to Sullivan Machinery Company.

ROCK DRILL. No. 1,681,198. Aug. 21, 1928. F. M. Slater, Easton, Pa., assignor to Ingersoll-Rand Company.

ROCK DRILL MOTOR. Nos. 1,680,247 and 1,680,250. Aug. 7, 1928. Charles H. Allen, assignor to Sullivan Machinery Company.

SINTERING METHOD AND APPARATUS. No. 1,680,345. Aug. 14, 1928. Henry J. Stehli, Cedar Grove, N. J.

PREPARING FLUE DUST FOR SMELTING. No. 1,680,107. Aug. 7, 1928. Frank F. Marquard, Clairton, Pa.

The patent covers that step in the process of treating iron ore flue dust for smelting which consists in mixing ammonia-still waste liquor with the flue dust.

MICA SEPARATION. No. 1,679,740. Aug. 7, 1928. Gustav A. Overstrom, Big Sur, Calif.

A method of separating mica from sand containing it, which consists in heating and drying the mixture, and subjecting the latter to temperature changes to develop pyro-electric action.

COPPER METALLURGY. No. 1,681,528. Aug. 21, 1928. Alexander Elliott, Los Angeles, Calif.

This patent covers the process of extracting copper from its ores by treating the ore with a solution of ferrous sulphate in the presence of air distributed in contact with the solution at a pressure higher than atmospheric.

FLOTATION. No. 1,678,312. July 24, 1928. Gale L. Adams, assignor to Standard Oil Development Company.

A flotation oil which comprises 80 per cent pressure-still tar, slightly over 19 per cent of residuum from hydrolysis of sulphated olefines, and slightly less than 1 per cent of soluble sodium sulphonate of petroleum hydrocarbons.

FLOTATION. No. 1,678,259. July 24, 1928. H. S. Martin, Garfield, Utah.

The method of effecting the selective froth flotation of copper sulphides from ores containing iron sulphides by making the pulp alkaline, adding a substance capable of liberating the sulphite radicle and hydrogen ions under the conditions obtaining in the flotation process, and then subjecting the pulp to flotation.

RECOVERING DIAMONDS. No. 1,679,857. Aug. 7, 1928. T. H. France, Brooklyn, N. Y.

An improvement in the recovery of diamonds from sedimentary rocks, by artificially heating the rocks to a substantial degree above normal atmospheric temperatures sufficient to induce material differences in expansion between the diamonds and their matrices and then abruptly cooling the so heated materials.

METALLURGY. No. 1,680,861. Aug. 14, 1928. Bror Christiansen, Smedjebacken, Sweden.

This patent covers a method of roasting and reducing ores, comprising transportation of the ore successively in a substantially horizontal direction through preheating, roasting, prereduction and final reduction zones of a channel furnace, subjecting the ore in the final zone to the reducing action of circulating reducing gases, recarbonizing said gases outside the furnace, and other features.

METALLURGY. Nos. 1,681,695 and 1,681,696. Aug. 21, 1928. Milton E. Branthaver, Shadygrove, Pa., assignor to American Milling and Refining Company.

These two patents cover the apparatus and means for liquid treatment of roasted ores, consisting essentially in the following: A roasting furnace comprising a roasting chamber with a floor provided with an ore discharge opening and an endless traveling conveyor to force the ore along the floor of the chamber and discharge it through the opening into a leaching pool or vat provided for receiving the hot ore, the liquid being directed into the ore in its passage from the furnace.

BULLETINS

PLATINUM WARE — Sigmund Cohn, 44 Gold St., New York. Precision platinum ware for the laboratory; pp. 4.

TABLES—Diesel Machine Company, Ft. Wayne, Ind. Plat-O tables, and other concentrating machinery; pp. 20.

ROCK DRILL—Sullivan Machinery Company, 122 So. Michigan Ave., Chicago. Bulletin 81T describing the L S rotator drill; pp. 16.

CONCRETE BREAKER—Sullivan Machinery Company, 122 So. Michigan Ave., Chicago. Bulletin 81U describing the K3 concrete breaker; pp. 8.

DROP FORGING — Interstate Drop Forge Company, 27th St. and Capitol Drive, Milwaukee. A four-page pamphlet explaining modern die construction and board drop hammer operation.

MOTORS — General Electric Company, Schenectady. Bulletin GEA-861. Direct-current, 230-volt, 1150-r.p.m., compound-wound, totally-inclosed, continuous-duty motors, 1 hp. and 5 hp.; pp. 4.

BLOWERS, METERS — P. H. and F. M. Roots Company, Connersville, Ind. General bulletin 10-B1 and Bulletin 40-B2 on the company's new positive displacement meter; pp. 12 and 8 respectively.

PUMP VALVES — Northern Pump Company, Minneapolis. A four-page bulletin describing the company's line of double-packed valves, formerly made by Victory Manufacturing Company, Niles, Calif.

SPARK PLUGS — Champion Spark Plug Company, Toledo, Ohio. "The Story of Champion Spark Plugs." A pictorial survey of their manufacture from raw material to finished product; pp. 60.

RESISTANCE THERMOMETERS—Brown Instrument Company, Philadelphia, Pa. Catalog No. 93. Resistance thermometers for measuring temperatures from —300 to +1,000 deg. F., indicating, recording and controlling; pp. 56.

NEWS OF THE WEEK

Summary

REQUEST for permission to lay off 50 per cent of the force employed at Mexico Mines of El Oro indicates exhaustion of orebody of this Mexican gold-silver producer. Page 352.

* * *

Strikes of high-grade copper have recently been made in the Bisbee district of Arizona by Shattuck Denn and Calumet & Arizona. A large flow of water was also struck at the latter property, taxing the capacity of the pumps on the 2,200 level. Page 348.

* * *

Study by the Department of Commerce of the interdependence of the various countries for mineral raw materials is practically completed and will soon be available for the public. Page 348.

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Sinking of the shaft at the Meteor Crater, near Winslow, Ariz., to locate the main body of the meteorite, is being pushed. Shaft will reach a depth of 1,600 ft. before lateral development is attempted. Page 350.

* * *

Western division of the American Mining Congress will meet with the Southern California section of the A.I.M.E. at Los Angeles on Sept. 10-13. Details of the program. Page 350.

* * *

Anglo-Oriental Mining properties produce 80 per cent of the total tin production of Nigeria. More dredges being sent to Malayan areas controlled by this company. Page 352.

* * *

First results of diamond drilling at Favorable Lake, Ontario's newest silver-gold camp, indicate 1,000 ft. of ore. Page 349.

* * *

The tantalite resources of Australia are being actively exploited. A discovery was recently made near Port Darwin. Page 348.

Anaconda Copper Retains Championship at International First-Aid and Mine Rescue Contest

ANACONDA COPPER retained the first-aid championship at the seventh annual International First-Aid and Mine Rescue Contest held at Butte, Mont., Aug. 20-22, when the team from the Great Falls, Mont., electrolytic zinc plant, captained by Fred I. Erickson, won the event. Second place went to Standard Oil of Louisiana, and third to the Great Falls, Mont., furnace refinery team of the Anaconda company. All three places in the mine rescue contest, and the three honors for the combination first-aid and mine rescue teams, were won by coal companies. Butte hospitality, well known in the mining world, was much in evidence at all times, particularly at the banquet held in the Masonic Temple the last day of the contest. In addition to W. W. Gale, attorney, Billings, Mont., who presided as toastmaster, those who addressed the gathering included Dr. F. H. Thomson, president, Montana School of Mines; Edwin Young, safety engineer, Great Falls Reduction Department, Anaconda company; Dr. R. R. Sayers, chief, Health and Safety Branch, U. S. Bureau of Mines; and W. B. Daly, general manager of mines of the Anaconda company. Following the addresses, prizes were distributed to the winning teams by Dr. Sayers.

Awards to the new championship first-aid team of Anaconda Copper included: Congressional bronze medallion, awarded by act of Congress; silver cup presented by *Coal Age;* silver cup presented by the Illinois Coal Operators' Association, Central Illinois Coal Operators' Association, Fifth and Ninth Districts Coal Operators' Association of Illinois, and United Mines Workers of America, District 12; silver cup presented by the National Coal Association; gold medals of the National Safety Council presented to each member of the team; and bronze medals of the American Red Cross awarded to each member of the team.

Silver and bronze medals of the National Safety Council were awarded to each member of the second and third teams, respectively, in the first-aid contest. Banners were presented to first-, second-, and third-place teams, and a banner was also awarded to the team having the highest score from each state represented in the contest.

Awards to the Northwest Improvement Company team that won first place in the mine rescue contest and highest honors among combination teams included: Congressional bronze medallion, awarded by act of Congress; silver cup presented by *Coal Age;* silver cup presented by the *Rocky Mountain News* and Denver *Times;* silver cup presented by *Modern Mining;* silver cup presented by the Concordia Electric Company; gold medals of the National Safety Council presented to each member of the team; Joseph A. Holmes challenge trophy; silver cup presented by the National Safety Council; silver cup presented by the Mine Safety Appliances Company. Six replicas of this silver cup were presented to the members of the team by the Mine Safety Appliances Company.

Silver and bronze medals were presented by the National Safety Council to each member of the second and third teams, respectively, in the mine rescue contest. Banners were awarded to first-, second-, and third-place teams, and a banner was also awarded to the team having the highest score from each state represented in the contest. Awards to combination first-aid and mine rescue teams also included banners to first-, second-, and third-place teams; six automobile first-aid cabinets, presented by the Mine Safety Appliances Company to the members of the team winning second place; and six automobile first-aid cabinets, presented by the Mine Safety Appliances Company to the members of the team winning third place.

In addition to the above-named prizes, the Rocky Mountain Coal Mining Institute awarded a silver cup and wrist watches to each member of the first-aid team, representing a coal mining company, a coal miners' organization, or a group of individual coal miners, making the highest score, from the Rocky Mountain states of Colorado, Idaho, Montana, New Mexico, Utah, and Wyoming. These prizes were won by the team of the Colorado Fuel & Iron Company, Walsen, Colo.

Mine operators of Butte, Mont., awarded a silver cup to the first-aid team from outside Montana making the highest score; this cup was won by the team of the Standard Oil Company of Louisiana, Baton Rouge, La.

Two New Copper Ore Strikes Made in Bisbee District

IN THE Bisbee district of Arizona, near the Mexican border, strikes of rich copper ore have recently been made at the Shattuck mine of Shattuck Denn Mining and near the Junction shaft of Calumet & Arizona. At the Shattuck mine a body of ore of unknown depth and length, averaging 40 per cent copper, has been uncovered, according to an official announcement. The strike in Calumet & Arizona ground was about 45 ft. from the boundary of the Ophir claim, owned by Shattuck Denn.

Not many details are available concerning either strike. It is stated that the strike at the Shattuck mine was made between the 400 and 500 levels in a section not heretofore explored extensively. The orebody is known to be 4 ft. wide, but depth and length have not yet been determined. This mine is one of the smallest in the district as regards extent of holdings, but it has been a fair producer ever since 1906, when shipments were first started. Some time ago geologists and mining engineers reported that its orebodies were exhausted, but it has continued to produce both lead and copper ores. Concentrates are shipped to the Calumet & Arizona smelter.

Assays of about 17 per cent copper have been obtained from the find at Calumet & Arizona. In recent years, several strikes of importance have been made in the neighborhood of the Campbell and Junction shafts of this company and have added greatly to ore reserves. A big flow of water was encountered in the mine at the same time as the strike and approximately 5,000,000 gal. was pumped in two days. This water, struck near the 2,200 level of the Junction shaft, caused such a heavy flow that the hydraulic station was closed to protect the pumps. It came from No. 2 crosscut and was lifted to the surface by the giant pumps on the 2,200 level in addition to the regular daily flow.

Great North Mines Will Treat Mass Mine Tailings

About 5,000,000 tons of tailings from the amygdaloid deposit of the Mass mine, at Keweenaw Bay, Mich., will be treated by flotation by Great North Mines. It is estimated that the tailings have an average recoverable copper content of 6 lb. per ton. This company is also exploring the Carp Lake copper property, in Ontonagon County. The tunnel that is being driven at this property is in 265 ft. and will be driven a total of 800 to 1,000 ft. It is hoped to encounter the vein in the latter part of the year.

Dr. G. F. Swain Receives Benjamin G. Lamme Medal

The first award of the Benjamin G. Lamme gold medal "for accomplishment in technical teaching or actual advancement of the art of technical training" has been made to Dr. George F. Swain, of Harvard University, Cambridge, Mass. Dr. Swain received his technical training at the Massachusetts Institute of Technology and the Royal Polytechnic School of Berlin. In 1887, Dr. Swain started his teaching work at M.I.T. Since 1909 he has been a distinguished member of the faculty of Harvard Engineering. Dr. Swain has served as a consulting engineer for the Massachusetts Railroad Commission and has been associated with a number of engineering enterprises, mainly in the field of transportation.

American Mining Engineer Is Murdered in Mexico

According to a telegram received by the U. S. State Department, Henry C. Schmidt, American mining engineer, of Monterey, State of Nuevo Leon, Mexico, was murdered at the Travador mine, Trinidad, Durango, 40 miles southwest of Torreon, on Aug. 18. The murder was committed by two unknown persons. General Escobar, in charge of the military district, has promised to co-operate with the American consul at Torreon in an effort to catch the murderers. Mr. Schmidt's body has been sent to Monterey, where he made his home. He was a member of the A.I.M.E.

Airplane Aids Geologic Work of Survey in Alaska

EXPLORATION parties of the U. S. Geological Survey have discovered a new use for the airplane. Technical men of one of the Geological Survey parties, going into the Mount Spurr region, the exploration of which was begun last year, "traveled by airplanes from Anchorage to the upper end of Lake Chakachamna, where field work will begin."

This summer six parties of the Survey are in the field in widely scattered areas of the territory. One party is making a reconnaissance topographic map of a part of the Ketchikan region of southeastern Alaska, which will also serve as a test of the results of photographic surveying, another phase of work done by airplane. A photographic survey by airplane was made two years ago and will be checked from the ground this year. Another bit of work that is under way in Alaska this summer is topographic mapping of a part of Admiralty Island. Yet another is that of carrying forward geologic investigations in the Nizina district of the Copper River region. Geologic reconnaissance in the upper Tanana and Yukon regions that lie west of the International boundary is also being advanced. The combined geologic and topographic reconnaissance work in the Alaska Range region of southwestern Alaska is going forward. Dr. Philip S. Smith, the chief Alaskan geologist of the Survey, is visiting some of the field parties.

Survey Shows Large Bauxite Deposits in Yugoslavia

YUGOSLAVIA possesses extensive deposits of bauxite, found mainly in the vicinity of the Adriatic Sea, on the islands, and in Dalmatia, southern Croatia, Herzegovina, Montenegro, and in Slovania, states Leslie A. Davis, U. S. Consulate, Zagreb, in a report made public by the U. S. Department of Commerce.

All the ore beds in Yugoslavia have not been surveyed, and no exact estimates of the deposits are available, but it has been unofficially reported that the deposits in these provinces have reserves in excess of 50,000,000 metric tons. Most important deposits are found in northern Dalmatia in the neighborhood of Drnis and in Herzegovina near the Mostar-Metkovic railway line. Great quantities have recently been discovered in Montenegro, between the towns of Bar and Ulcinj.

In Croatia the deposits in the country of Lika are the most important, but they are not exploited at present owing to the large content of impurities in the ore. The deposits in Dalmatia are plentiful and the quality is much better, it is said, the ore having only about 0.25 to 3 per cent of silica. Similar conditions exist in Bosnia. The Herzegovinian bauxite, especially that found in Citluk, is even better than the bauxite of Dalmatia. The Herzegovinian bauxite is not exploited at present, on account of poor means of communication.

Since the war exploitation has developed to such an extent that in 1925 Yugoslavia held fifth place among the bauxite-producing countries of the world, furnishing about 9 per cent of the world's production exclusive of the United States, and in 1926 it rose to fourth place.

Treadwell Yukon Closes Zinc Contract with British Metal

A three-year contract under favorable terms has been closed by Treadwell Yukon with the British Metal Corporation, Ltd., for the company's zinc concentrates produced by its Errington mine, in the Sudbury district of Ontario. Other European companies competed for the concentrates, but the English company made the best terms and was awarded the contract. Import duties on zinc prevented marketing of the concentrates in the United States.

Gold Cord Ships to Smelter at Tacoma

In the Willow Creek district of Alaska, near Alaska, the Gold Cord mine has made two shipments of gold ore to the Tacoma smelter of A. S. & R. This property is now operated by Golden Bear Mining, of Los Angeles. It consists of nine patented claims on Fishhook Creek and was first developed in 1917. The vein is averaging 3 ft. in width.

Keen Interest Shown in Australian Tantalite

THE Pilbara field, Western Australia, is the principal producing center of tantalite in that continent. Messrs. Young & Moulden, of Adelaide, work leases at Wodgina and also purchase any small lots offered. The production in 1926 was 19.45 tons, valued at £2,357. In 1927 the output fell to 15.28 tons, but the value was higher—namely, £3,808. Output is regulated by the demand. The firm mentioned is under contract to sell the whole output to an American concern.

Tantalite also occurs in association with tin in the same district and at Greenbushes, but the separation is a difficult matter. It has also been reported from Coolgardie.

In the Northern Territory, Messrs. James Gitsham and A. J. Johnson are developing a find of tantalite on the Finnis River, about 65 miles from Port Darwin. They have a contract for the supply of 20 tons to the Fansteel company, of New York. Inquiries are reaching Australia from Great Britain, America, and Europe, and the price offered has increased from 30s. per unit for 60 per cent ore to 80s. Some buyers offer to accept concentrates containing as low as 45 per cent Ta_2O_5.

Soviet Manganese Concession Tangle Settled

An Associated Press dispatch in the New York *Times* of August 26, dated from Paris, stated that the differences between the Soviet government and the W. A. Harriman interests over the Georgian manganese are understood authoritatively to have been settled by an agreement reached in Paris after long negotiations between George Tiakatov, chief of the Soviet trade delegation in Paris, and Richard Robinson, of Harrimans. It is understood that this agreement, which makes resort to arbitration unnecessary, cancels the Tchiatouri manganese concession operated in the Republic of Georgia by the Harriman interests through the Georgian Manganese Company.

Eventually the Harriman interests are to be repaid their investment, amounting to several million dollars, but meanwhile they are to arrange a commercial loan for the Soviet authorities to develop the manganese industry. The former owners are to get back the properties that the manganese company operated.

Two Mines in Patagonia District Are Being Reopened

UNDER the management of Frank Alberg, the World's Fair mine and the Trench mine, situated in the Patagonia district, Santa Cruz County, Ariz., will resume development work and production, according to reports. The main tunnel at the World's Fair, 1,350 ft. in length, has been cleaned out and retimbered and the mine is now ready to produce. Ore is silver-lead-gold and occurs in a rhyolite-diorite contact deposit. The Trench shaft, which is about 600 ft. deep, has been unwatered and the workings have been cleaned out. The orebody is similar to that in the World's Fair.

It is reported that all the ore taken from the two properties will be treated at the mill at the World's Fair, which has been remodeled during the last few months, under Alberg's direction. A good road has also been built to the properties.

Champion Sillimanite Asks for Power Permit

APPLICATION has been made to the Federal Power Commission by the Champion Sillimanite Company, Inc., of Bishop, Calif., for a license covering a water-power project on Milner Creek, near Bishop. It is proposed to divert the entire natural flow of the creek through a conduit, 10,000 ft. long, to the power house, operating under an 880-ft. head. In this way, the company will develop 225 hp. for use at its property.

The commission recently issued a license to Bunker Hill & Sullivan, operating in the Coeur d'Alene district of Idaho, which allows it to construct a 350-hp. plant on the Deadwood River, near its mine.

Brooklyn Polytechnic Offers Evening Graduate Courses in Engineering

OPPORTUNITY is afforded to engineers, chemists, and other technicians in the metropolitan district of New York City to pursue graduate study during the evening hours. The Polytechnic Institute of Brooklyn will parallel its regular day curricula by offering this fall four graduate courses in the evening which lead to the master's degree. These courses permit properly qualified graduates of universities and technical colleges who are engaged during business hours to continue their studies in chemistry and engineering.

Some of the subjects of instruction to be given this fall are: engineering economics, advanced physical chemistry, advanced organic analysis, drying, evaporation and distillation, water-power engineering, advanced structures, electrical oscillations, electromagnetic theory, heat power engineering, metallography and heat treatment, oil and gas power engineering, differential equations, advanced mechanics, and quantum theory of radiation.

Graduate classes will open on Sept. 24, and registration may be made on and after Sept. 10 by application to the Dean. The Polytechnic Institute is on Livingston and Court St., immediately adjoining Borough Hall, in Brooklyn.

Good Ore on No. 5 Level at Kassan Gold

ACCORDING to W. J. Elmendorf, consulting engineer of Kassan Gold, who just returned to Seattle from a visit to the mine on Prince of Wales Island, Alaska, high-grade ore has been opened and followed in the south crosscut on the No. 5 level of the mine. This ore was struck about 140 ft. from the shaft. It has been developed for a distance of 40 ft. along the drift, and was still persisting at the time of his departure. The last ore opened shows some free gold. The extent of the orebody is not yet known. However, crosscutting has been started on the No. 6 level in the expectation of striking a downward continuation.

The mill at present is operating only one shift a day. However, it is hoped to put it on a two-shift basis as soon as production is effected from the No. 6 level.

New Patent Granted for Electrical Prospecting

A PATENT (No. 1,678,489 U. S. A., granted July 24, 1928) was recently granted to Karl Sundberg, of the Swedish American Prospecting Corporation, for a new device which makes possible the determination of the ratio between the strengths of the electromagnetic fields at two different points or between components of the same field at one point. It is being extensively used by the A. B. Elektrisk Malmletning, of Stockholm, Sweden, to which Mr. Sundberg has assigned his patent, and by Swedish American Prospecting Corporation, of New York, which has the sole license for the western hemisphere.

The method covered by the newly issued patent was invented in the fall of 1923 and has been called the "two-frame method," because the essential features are two frames or coils, connected to each other. The Boliden orebody in northern Sweden, which carries a large amount of gold and arsenic, was discovered in 1924 by the two-frame method.

Ardsley Butte Sinks Shaft

It was decided last week by the management of Ardsley Butte Mines to sink the main shaft at its Highland group to the 550 level. Work was begun immediately from the 365 level, and the shaft has already been sunk more than 20 ft. A triplex plunger pump, with 50 hp. motor, is being installed on the 365 level.

Find Silver-Lead at Wrangell

A silver-lead deposit has been located on Coronation Island, near Wrangell, Alaska, by prospectors from Vancouver, B. C. The samples that have been brought back are cerussite. It is said that the mineral occurs in boulders on the beach and that the vein is traceable on the mountain-side.

Western Division of Mining Congress to Meet Sept. 10-13

MEETING at Los Angeles on Sept. 10-13, the Western division of the American Mining Congress will present a program of discussion of questions of importance to the mining industry at large and of the Western country in particular. The convention, which is an annual event, will be attended by delegates from Washington, Oregon, Montana, California, Nevada, New Mexico, Arizona, Colorado, Oklahoma, Idaho, Utah, South Dakota, and Wyoming. Phillip Wiseman, of Los Angeles, governor of the Western division, is in active charge of arrangements for the convention, assisted by J. F. Callbreath, secretary of the American Mining Congress; W. C. Brown, secretary of the Western division, and a committee consisting of J. B. Hodgson, Arizona; Robert Linton, California; J. W. Ady, Colorado; C. W. Newton, Idaho; C. S. Berrien, Montana; J. C. Kinnear, Nevada; R. B. Tempest, New Mexico; A. T. Winther, Oklahoma; and Frank M. Smith, Washington.

Though the program has not yet been completed, a number of speakers have already accepted invitations to address the convention. These include J. B. Pullen, who will speak on underground ventilation problems at the Copper Queen mine of the Phelps Dodge Corporation; H. H. Pratt, on Diesel engines as a source of power; and T. O. McGrath, on mining problems at the Argonaut mine.

Sessions of the Southern California section of the A.I.M.E. and of the California Development Association will be held simultaneously with the meeting of the Western division. The following represent a committee for the Institute which is arranging its part in the program: J. A. Carpenter, of Reno; W. F. Deitrich, of Stanford; H. S. Gale and A. B. Tucker, of Los Angeles; G. J. Young, of San Francisco; and E. P. Mathewson, of Tucson. Other committees for the convention are as follows: Executive committee: Phillip Wiseman, Robert R. Boyd, and C. S. Knight. Guy N. Bjorge is secretary of the general committee; Ward Blackman, chairman of the finance committee; Edward Higgens, chairman of the publicity committee, and Robert Linton, chairman of the program committee.

Various groups of mining interests in the Western states will participate in the convention. Among those to be represented will be the Copper Queen Branch of Phelps Dodge Corporation, of Arizona; Homestake Mining, of South Dakota; Anna Beaver Mines, of Oklahoma; Portland Gold Mining, of Colorado; Anaconda Copper Mining, of Montana; Nevada Consolidated Copper; the Cœur d'Alene district of Idaho; Utah Copper; Argonaut Mining, of California, and the California Metal and Mineral Producers' Association.

E. P. Mathewson and Robert Linton will preside over two sessions of the Institute, at which the speakers will include George Otis Smith, Director of the U. S. Geological Survey and president of the A.I.M.E.; J. B. Tenny, who will speak on the need of an electrolytic zinc plant for the Southwest; David Hall, who will talk on high efficiency motor-generator sets for leaching plants; C. A. Mitke, who will discuss the various methods of block caving; Irving A. Palmer, who will discuss flotation; George J. Young, whose subject will be the possibilities of nonmetallic mineral development in the Pacific States; Walter W. Bradley, who speaks on the general occurrence of nonmetallic minerals in California; C. W. Davis, whose subject is "Some Properties of Oil-Bleaching Clays"; and P. B. Butler, who will discuss "The Occurrence and Use of Tripoli."

Meteor Crater Shaft Now Down 140 Ft.

AT THE Meteor Crater, near Winslow, Ariz., the shaft being sunk by Meteor Crater Exploration & Mining to find the main body of the meteorite is now down 140 ft. Plans call for a total depth of 1,600 ft. and a drift to the point where the main body is supposed to lie. The ore is expected to contain iron, nickel, platinum, and iridium. Present progress amounts to about 7 ft. a day in the hard sandstone formation. Three shifts of 37 men are working at the mine 24 hours a day. Work is being done by contract.

A detailed article dealing with the plans and expectations of the Meteor Crater appeared in *Engineering and Mining Journal* of May 26 as the seventh of E. H. Robie's articles on Arizona mining camps.

Spanish Potash Industry Enters Productive Stage

AT A RECENT meeting of shareholders of the Union Española de Explosivos the statement was made that work on the potash mines of this company at Cardona, in the Province of Barcelona, Spain, had been going forward actively and normally, and that borings on the first shaft had been suspended at a depth of 450 meters, according to a report from N. B. Stewart, U. S. Consul General at Barcelona, made public by the Department of Commerce.

Other borings reached the deposit of sylvanite which contained on an average from 24 to 26 per cent of potash. The deposit of sylvanite has a thickness of 20 meters and is found at 500 to 600 meters depth. Plans have been made to prolong the shaft to 700 meters, in order to work from the bottom upward, carrying out the exploitation with two shafts. The two shafts are expected to permit the extraction of 60 tons and 150 tons per hour respectively.

Cost of transportation is reported to be satisfactory. Sale of potash will start soon. Carnallite which is encountered at higher levels has been for the moment abandoned in favor of the sylvanite, which is said to offer better prospects.

The potash development of this company at Cardona has been the cause of speculation in its securities. It appears, however, local observers declare, that the company has valuable deposits of potash which may become a source of revenue.

Silverton Mine Is Deepening Its Workings

COLORADO-MEXICO Mining, situated at Silverton, Colo., has deepened its Melville shaft an additional 100 ft., according to G. E. De Beque, manager of the property. Ore has been encountered at the new level, and development work will be prosecuted to put the mine in condition for production of 100 tons daily by July 1, 1929, when the lease of Shenandoah-Dives Syndicate on the Iowa mill, belonging to Colorado-Mexico, will expire.

The old mill was recently remodeled by Shenandoah-Dives to handle the output of that company's Mayflower mine. New machinery, consisting of a crusher, a ball mill, ore feeders, a Minerals Separation flotation unit, a Dorr thickener, classifier and filter, has been installed. During the period of the lease of the mill to the Shenandoah-Dives, Colorado-Mexico reserves the right to have its ores treated there.

Swedish Iron Ore Strike Is Settled

The strike of workers in Swedish iron ore mines which has seriously disturbed the economic situation in that country since January has been settled, according to information just received, and the employees have returned to the mines. A premature report had appeared stating that the strike was settled on Aug. 8, but this was erroneous, it is said by authorities in New York. Work will be resumed Sept. 1.

Atlin Silver Lead Not Optioned by C. M. & S.

The president of Atlin Silver Lead Mines, Mr. J. M. Ruffner, has courteously directed attention to the fact that a report in the issue of *Engineering and Mining Journal* of Aug. 18, to the effect that Consolidated Mining & Smelting of Canada had taken a lease and option on the property of the Atlin Silver Lead Company at Atlin, B. C., is without foundation. The item was received from a regular correspondent. Its publication is regretted, and the opportunity to make correction is most welcome.

Flin Flon Lake and the property of Mandy Mines photographed from the air

Mandy Cuts Ore at 425 Level

At the Mandy mine, in the Flin Flon district of northern Manitoba, the north crosscut on the 425 level has cut 5 ft. of copper ore, said to assay 10 per cent. Very little is being given out concerning new developments, but it is stated that geological conditions on the upper level have been duplicated on the three new levels, the 325, 425, and 525. The schisted zone is about 125 ft. wide. Mandy is controlled by Tonopah Mining of Nevada.

Kootenay Florence Tunnel Strikes Mineralization

AT ABOUT 3,450 ft. from its portal, the long tunnel being driven by Kootenay Florence Mining, at its Florence mine, near Ainsworth, B. C., has found mineralization in the limestone formation. A drift to the south on a narrow vein that was cut just before the limestone was entered, found the end of the vein within a few feet, but a drift in the opposite direction showed the vein increasing in width with every round of shots. In less than 50 ft. of drifting it had widened to 13 ft. of milling ore between walls. It is presumed that this is the downward extension of one of the oreshoots developed in the old workings, 550 ft. above the new tunnel.

Power is now obtainable at the mine, as the transmission line from the city of Nelson's power plant, at Bonnington Falls, to the mine has been completed. Nelson has undertaken to provide all power needed up to 600 hp. Ultimately the power will be used for all operations at mine and mill. Remodeling of the mill will not be started until the orebodies on the new tunnel level have been more thoroughly developed, as the capacity needed will not be known until then.

Humboldt Sulphur Installs Steam Power

Humboldt Sulphur, operating a flotation plant at Sulphur, Nev., has recently replaced its Diesel engine by a Wolf steam plant. This is an oil-fired unit of 350 hp. and is now used to drive the flotation plant, which is treating 180 tons of dump material a day. Heads average 17 per cent sulphur and the tailing averages 2 per cent. There is a recovery of about 300 lb. of sulphur per ton.

The operators expect to bring the heads to 22 per cent sulphur when actual quarrying is started.

Diamond Drills at Favorable Lake Give Good Results

DIAMOND drilling and surface trenching at the Favorable Lake property, recently discovered in northern Ontario, have indicated ore over a length of 1,000 ft., according to reports received from Toronto. It is said that the limits of the vein have not yet been determined. The results for the first three holes show widths ranging from 6 to 12 ft., with assays averaging about $12 in gold and silver.

Holes are being put down 50 ft. apart and are being drilled to a depth of 125 ft. The ore, in addition to gold and silver, carries some lead and zinc, but because of the distance from the railroad, their value is problematical. The property is 230 miles north of the railroad at Hudson, Ont., which is the station used by the Red Lake district.

Genii Mining Completes Adit to 1,000-Ft. Point

GENII Mining, operating at Magalia, Calif., has extended its adit about 1,000 ft. It is estimated that the total distance necessary to intersect the Mammoth channel is 3,200 ft., and about seven months more will be required to reach the channel. The site and grade of the tunnel are such that the company expects to cut the channel 50 to 70 ft. below bedrock. The position of the channel has been determined by the location of the runs and by some old workings.

Progress in tunnel driving averages about 14 ft. per day. Three shifts are worked and sixteen men are employed at present by the contractor driving the tunnel. Equipment consists of a motor-driven Ingersoll-Rand compressor and a drill-sharpening shop provided with power sharpener. Transportation has been by hand tramming, but it is planned to install an electric locomotive of the storage-battery type in the near future.

Survey of International Mineral Distribution Is Almost Completed

By Paul Wooton
Special Washington Correspondent

AN EXHAUSTIVE survey to establish in a thorough and detailed way the interdependence among nations for mineral raw materials has been practically completed by the minerals division of the U. S. Bureau of Foreign and Domestic Commerce and by the statistical division of the U. S. Bureau of Mines. It will be the first of the year, however, before printed copies of the report, which will contain 380 printed pages, will be ready for distribution.

The report covers 80 per cent of the tonnage and 70 per cent of the value of minerals carried in international commerce, but is confined to the interchange among the United States, Germany, France, the United Kingdom and the British commonwealths, Japan, Belgium, Italy, and Spain.

The first study will make available in one volume for the first time all obtainable information as to the procurement and consumption of the major metals of commerce in the countries mentioned. The manuscript of this report has been submitted to persons in the industry who are particularly well qualified to pass upon its accuracy and its value. All suggestions that have been made looking to the improvement of the report have been incorporated in it, so as to bring out the maximum of benefit to those who will have occasion to use the publication.

Noranda Smelter Treating Larger Tonnages

Production of the Noranda Mines smelter, at Rouyn, in northern Quebec, is steadily increasing. Work on the new concentrator is proceeding rapidly, and this new plant, with a capacity of 500 tons daily, should be ready for operation late in October. According to figures recently released, the smelter treated 800 tons of copper-gold ore a day during July, and August has shown further increases. A record day of 998 tons was recently attained. By the close of the year, the management expects to be handling about 1,500 tons a day. It is reported that the plant is recovering 93 per cent of the copper contained in the ore.

Ready Bullion Changes Hands

Arrangements have been completed whereby Messrs. Kinney and Gillis will take over the Ready Bullion mill at Fairbanks, Alaska, for the purpose of treating gold ore that they have developed. A good clean-up has been made on ore from the dumps at Ester Creek which were taken out last winter. The pay gravel there is said to have a depth of 110 ft.

London Letter

By W. A. Doman
Special Correspondent

Anglo-Oriental Mining Group Produces 80 Per Cent of Nigerian Tin

London, August 14, 1928.—When Anglo-Oriental Mining was formed, an annual output of 15,000 tons of tin concentrates was expected of the group. Last month, the properties involved produced 882 tons, which is only about 10,500 tons a year, equal to about 7 per cent of the total world output. Of the 882 tons, Far Eastern claims contributed 425 tons and Nigerian members, 436 tons, the latter representing about 80 per cent of the total Nigerian production and showing the importance of the combination.

I understand that one of the areas acquired from the Australian company in the Kinta Valley, F.M.S., was previously regarded as virtually unworkable. It is in very swampy ground and not amenable to Chinese methods of working. An up-to-date dredging plant, however, is digging 86 ft. below water level and is recovering good values. As additional dredges are being installed, the controlling authority would not appear to be afraid of overproduction. There seems to be something in the background in connection with the price of tin that is not quite clear. Rumors reach me that the parties who have hitherto manipulated the figures are beginning to take stock of the new position. It has been stated that the Anglo-Oriental, in order to have a voice in the price, has accumulated large stocks and tied up its money with the object of keeping them off the market. This, I am assured from another quarter, is devoid of foundation, and is set about to discredit certain parties. It all goes to make the position interesting and shows what a powerful factor Anglo-Oriental has become in the tin market within a short time.

SHAREHOLDERS in Southern Rhodesia Base Metals Corporation have had something of a shock. They had been led to expect favorable reports concerning their properties, but Dr. W. S. McCann, who has surveyed them, is rather depressing in his conclusions. The reasons he gives for not holding out much hope concerning the Copper King and the Copper Queen are as follows: (a) Absence of secondary enrichment below the oxidized zone; (b) nonpersistence of the deposits to reasonable depth, owing to their folded structure; and the fact that erosion has removed most of the original deposits, so that mere remnants remain; (c) the great width of gossan (oxidized outcrop) gave an exaggerated impression of the size and continuity of the oreshoots. Regarding the Gondia mine, Dr. McCann says that in any event it could never become even a moderately large property.

At a meeting, held today, of representatives of the principal nitrate producers and distributors, a new marketing scheme was formulated, according to report, and cabled to Valparaiso for the consideration of the Chilean government. A reply from the latter is expected soon.

Melbourne Letter

By Peter G. Tait
Special Correspondent

Mount Morgan Mine May Be Acquired and Reopened by a New Company

Melbourne, July 25, 1928.—There is talk of reopening the famous Mount Morgan mine, in Queensland, by a new company with a capital of £250,000. So far all that has been done is that the representative of a Sydney syndicate has inspected the property and is negotiating with the liquidators for an option of purchase over the company's leases and plant. In view of the fact that the old company did not consider it worth while to dissipate its accumulated reserves in continuing operations at a loss, it is difficult to visualize another group of investors being prepared to take the risk. However, if anything is to be done it is a wise step to make the effort while the property is a going concern, and not to wait until the plant is dismantled.

One thing in favor of the scheme is the assurance that 8,000,000 tons of copper-gold ore of an average value of £2 per ton is available. The question is, however, whether this ore can be mined and treated at a profit. The promoters apparently are sanguine that they can purchase sufficient tonnages of high-grade copper ore from the Cloncurry field to make treatment profitable, or perhaps they are banking on an increase in the market price of copper.

THE quicksilver deposits of New Zealand have been developed and worked intermittently over a period of years. The principal occurrences are at Puhipuhi and at Ohaeawai, in the north of North Island. In 1917 the New Zealand Quicksilver Company was formed to take over the Whangarei Cinnabar Company's plant and bases at Puhipuhi. During the period of the World War the Whangarei company produced £8,000 worth of mercury. Its successor produced 11,296 lb. of mercury in 1918, but difficulties were experienced and operations ceased.

For some months R. H. Goodwin, a British metallurgist who has had considerable experience with quicksilver in Asia Minor and elsewhere, has been investigating these deposits on behalf of the Imperial Chemical Industries, of which Nobels is an associated company, and it is now reported that they have acquired a property at Ngawha, near Ohaeawai, and will immediately proceed with its active development.

Mexico City Letter

By W. L. Vail
Special Correspondent

Mexico Mines of El Oro Asks Permission to Lay Off 50 Per Cent of Force

Mexico City, August 17, 1928.—The management of the Mexico Mines of El Oro has made a formal request to be permitted to lay off 50 per cent of the men now engaged on the property. At present about 500 are employed. Mexico Mines reached bottom some time ago, and is now engaged in cleaning up the remaining ore, a process which will probably be completed early in 1929. This famous silver-gold property, situated near El Oro, State of Mexico, has been producing steadily for the last twenty years. It has declared dividends totaling more than £2,000,000 in that time, although capitalization amounted to only £210,000. The ore carried about $10 in gold and 10 oz. of silver. T. H. Carter Mitchell is general manager.

It is stated that laying off of men at the No. 2 smelter of the Peñoles Company at Monterey, Nuevo Leon, was due to construction work being completed there. Requests have also been made by other companies, including the International of Coahuila and the Unidad y Difficultad-Purissima at Pachuca, belonging to Real del Monte, for permission to decrease the number of men employed.

A 125-ton mill was recently started on the property of San Diego y Anexas, State of Morelos, to treat the silver-lead ore from the mine, which is 46 kilometers from the railroad at Tlalquiltenango. An automobile road has been completed to the property. This mine has a history dating back to the Spanish Colonial days, when several rich strikes were made. It was later worked extensively by a British syndicate and is now controlled by French capital. Morton Webber is managing director and George Millar superintendent. The mill was constructed by Southwestern Engineering, of Los Angeles.

THE MINING department of the government has declared that the following properties will be forfeited and open to re-denouncement unless taxes accrued are paid into the national treasury before Sept. 13: Guadalupe, La Firmeza, and El Castigo, Chihuahua; San Isidro de la Puerta and San Antonio de los Tiros, Guanajuato; El Aguila, Aguas Calientes; Santa Isabel, Zacatecas; La Victoria, Michoacan; and Los Reyes, Puebla.

A safety-first demonstration will be held here on Aug. 26 under the auspices of the Secretary of the Department of Commerce, Labor and Industry. Several teams from many of the most important mining districts will participate as well as representatives of machinery manufacturers.

Personal Notes

SIR GEORGE BURY has been elected president of Canada Quebec Mining Corporation.

W. A. MCKENZIE has been appointed Minister of Mines for British Columbia in the new administration under the leadership of Dr. F. S. Tolmie.

FRANK M. ESTES, general manager of Dolores Esperanza, was in New York recently on business. He has returned to Madera, State of Chihuahua, Mexico.

Dr. FRANCIS A. THOMSON, recently appointed president of the Montana State School of Mines, was married at Seattle recently to Miss Edna L. Michaelsen, of Spokane.

H. D. KEISER, assistant editor of *Engineering and Mining Journal*, has returned to Salt Lake City from Butte, Mont., where he went to report for this journal the International First-Aid Meet.

GEORGE W. STARR, of the Empire Mines, Grass Valley, Calif., recently returned from a trip to South Africa. He was one of a party in which were C. B. Lakenan, E. S. Berry and Carl Jones.

HERBERT H. BUSH, who has been in private practice in Johannesburg for some time, has been appointed assistant consulting engineer with the Johannesburg Consolidated Investment Company, Ltd.

D. H. MCLAUGHLIN, professor of mining engineering at Harvard University, Cambridge, Mass., was in Mexico recently on professional work and returned through San Francisco en route to Cambridge.

S. N. PARKER, mining engineer of Idaho Springs and Cripple Creek, Colo., has been appointed superintendent of operations for Gold Crescent Mines, which owns properties on Ironclad Hill, in the Cripple Creek district.

L. K. WARD, government geologist of South Australia, has been appointed leader of an expedition which has been organized by the Australian Commonwealth to investigate artesian water supplies in the Northern Territory.

JOHN GILLIE, veteran consulting engineer and for many years general manager of mines of the Anaconda Copper Mining Company, at Butte, was recently married to Mrs. Margaret Meagher Veazey, of Butte, a member of a prominent pioneer family of Montana.

W. E. SIMPSON, mining engineer of Swastika, Ont., has accepted the position of consulting engineer to Barry-Hollinger Gold Mines and Patterson Copper, both operating in the Boston Creek district, near Kirkland Lake, Ont. Mr. Simpson has had a wide experience in Australia and Canada.

EVAN J. WILLIAMS has been elected president of Silver Leaf Metals, Inc. Mr. Williams has been superintendent of the Blue Bird mine, in the Cripple Creek district of Colorado, ever since Silver Leaf acquired the property. WILLIAM G. HALDANE has been appointed general manager of the mine.

JAMES K. DICKSON, mine superintendent of Benguet Consolidated Mines, returned to the mine recently from a trip through the mining districts of

CAPT. JAMES K. DICKSON

Northern Luzon, P. I. Captain Dickson was for several years associated with Anaconda Copper at Butte, Mont., and later joined the U. S. Geological Survey in Alaska.

ARTHUR A. ZENTNER, formerly with Anaconda Copper, arrived recently in New York from Germany and England, where he spent eight months on consultation work in connection with electrolytic zinc developments. While in Germany Mr. Zentner observed the operation of the Waelz zinc process. Mr. Zentner, who left New York again on Aug. 28, expects to be back at his headquarters in San Francisco about the middle of September.

L. L. KIRTLEY, C. R. KLINKENBERG, K. S. BEISEL, and H. O. WALKER, field and laboratory men for the Radiore Company of Los Angeles, have arrived in the Michigan copper district to take charge of the work of exploring the tract of land owned by Champion Copper, which was recently turned over to it by Copper Range and St. Mary's Mineral Land.

E. BACHMAN, electrical engineer, General Electric Company, whose headquarters are at Salt Lake City, has been granted a leave of absence, during which time he will serve in a consulting capacity with the Hudson Bay Mining & Smelting Company. Mr. Bachman will be engaged in constructing the hydro-electric power plant at Island Falls and the electrical features of the smelter that will treat the ores from the Flin Flon property of the Hudson Bay company.

OBITUARY

LESLIE STALEY, a student at the New Mexico School of Mines at Socorro, N. M., was killed near Santa Fe on Aug. 7, when he fell 165 ft. down a mine shaft. He was a brother of C. G. STALEY, state geologist of New Mexico.

O. N. ALVIN, formerly master mechanic of the Copper Queen branch of Phelps Dodge, was instantly killed while working on a steel construction project at the Warman Steel Casting Company plant in Los Angeles. Mr. Alvin lived in Bisbee for nearly twenty years before going to Los Angeles.

ALLEN C. REDDING, metallurgical chemist, died recently at San Simeon, Calif. He was 73 years old. Dr. Redding was a graduate of the Michigan Agricultural College and took a post-graduate course in chemistry. For the last 20 or 25 years Dr. Redding was engaged in metallurgical chemistry and assaying. He was connected with the firm of C. A. Luckhardt Company, San Francisco.

ERNST HARMS, metallurgical engineer, of Los Angeles, died at that city on Aug. 12. Mr. Harms was born at Rock Island, Ill., on Feb. 18, 1872. He attended the University of Illinois for two years and then went abroad, studying at the Royal School of Mines, Freiberg, Saxony. He graduated in 1892, receiving the degree of metallurgical engineer. His first professional engagement was with Consolidated Kansas City Smelting & Refining, at Argentine, Kan. Subsequently he was connected with the El Paso Smelting Works; the Carmen smelter, at Boquillas, Mexico; the Silver City plant of A. S. & R.; and the Cia. Metalurgica de Torreon at Torreon. Since 1923 he had been engaged in the hydro-metallurgical treatment of complex zinc ores at Los Angeles.

ROBERT M. RAYMOND, professor of mining at Columbia University, New York City, died at Prescott, Ariz. on Aug. 23. He was 70 years old. Professor Raymond was a native of New Brunswick, Canada, and a graduate of the University of New Brunswick and the Columbia School of Mines. Previous to his connection in a professorial capacity with Columbia, he engaged in engineering practice in the United States and Mexico, being connected with the operations of the Exploration Company, Ltd., a London syndicate with interest in the El Oro, Buena Tierra, Santa Rosa, Greene-Cananea, and other large mines. Services were held in the Columbia University chapel on Aug. 28 and burial was in Scarsdale, N. Y., on the following day. An appreciation of Professor Raymond's life and accomplishments will appear in an early issue of *Engineering and Mining Journal*.

BOOK REVIEWS

THE TREND OF FLOTATION. By Arthur Weinig and Irving A. Palmer. Second edition, revised. Colorado School of Mines, Golden, Colo.

FLOTATION practice advances so rapidly that another edition of this practical 90-page book by Professors Weinig and Palmer is appropriately issued a year and a half after the first edition. It is to be hoped that further editions will appear at suitable intervals, and that the idea will spread to other mining schools. One school, for example, might issue a similar bulletin giving the current practice on ore crushing and grinding; another on mining methods; another on hydrometallurgy of the base metals; and so on. All of the more pretentious books on flotation are pretty well out of date, though of course there is A. F. Taggart's able treatment of the subject in his "Handbook of Ore Dressing," published in the spring of last year.

The second edition of "The Trend of Flotation" covers much the same ground as the first as we remember it, some one having stolen our original copy. Consideration is given to theory, reagents, equipment, and accessory operations, testing, costs, royalties and patents, marketing of concentrates, and related data. A good part of the book gives the operating data for individual mills, admirably condensed, and a good bibliography and index complete a well-rounded little volume.

No better condensed handbook of current American flotation practice is available, and it is no wonder that the first edition of 5,000 copies was quickly exhausted, especially in view of the fact that the book costs nothing, being one of the gifts of the Colorado School of Mines to metallurgical progress.

E. H. ROBIE.

MINING DIRECTORY OF MINNESOTA, 1928. By John V. Craig. Published by the University of Minnesota, Minneapolis; pp. 229. Price, $1.

This handy directory of the Minnesota iron ranges is divided into five parts. Part I contains maps compiled by the Mines Experiment Station showing the name and location of all operating mines; also mines that have been exhausted, as well as reserve properties. The beneficiation plants are also shown. Part II contains a list of all the mines or mining properties that have shipped ore or are listed on the tax records as containing either merchantable ore or non-merchantable ore that may some day become merchantable. All properties that have shipped ore or are about to ship it are classified as mines. This part constitutes the major portion of the directory. Part III contains a list of the various mining companies and holding organizations identified with the Minnesota iron ranges, together with a list of the officials, subsidiary companies, and the properties in which they are interested. Part IV contains a short history of the iron ranges, among other things, and tables of general statistics. Part V includes a partial list of the names and addresses of men associated with the mining industry of the state.

WOOD PRESERVATION—A paper entitled "Wood Preservation in Western Australia," which was read before the Chemical Society of Western Australia, is printed in the July 5 issue of the *Chemical Engineering and Mining Review*, of Melbourne. The author is C. R. Kent. Until recent years only one process of preserving wood—namely, the Powellising process—had been used to any extent in Western Australia. Invented by William Powell, this was patented in England and throughout the world in 1904 and was first introduced into Australia in 1905. As applied in the initial tests, it consisted in boiling the green timber (karri) in an aqueous solution of molasses for a given length of time, which depended on the thickness of the material. By this means, it was claimed, the process rendered the timber immune to dry rot or fungoid attack. Later arsenic was added to the solution in the form of arsenious oxide, this purely as an insecticide to prevent termite attack. The solution employed in Powellising has the following compositions: molasses, 11 per cent; arsenious trioxide, 1 per cent. In 1924 discouraging reports were received from certain districts in regard to the rapid failure of Powellised karri due to rot. J. E. Cummins investigated the matter and concluded that the process did not afford sufficient protecting against rot-producing fungi. As a result of further work on his part a new process under the name of "fluarising" was patented by the Forests Department and was established on a commercial scale in 1926. Results obtained fulfilled the expectations engendered by the preliminary experiments. The procedure differs from the Powellising process in minor points only. The solution employed has the following composition: fungicides — sodium fluoride, 3.5 per cent, and sodium dinitrophenate, 0.3 per cent; insecticide—arsenious trioxide, 1 per cent.

DIATOMITE — The *Canadian Mining and Metallurgical Bulletin* for August contains a sixteen-page article entitled "Development of Diatomaceous Earth in Nova Scotia," by Reginald W. Burroughs. The largest Canadian deposits of this material are found in Nova Scotia and British Columbia, with smaller impure deposits in Ontario, Quebec, and New Brunswick. At present active operations in Eastern Canada are confined to two deposits—those of the Oxford Tripoli Company in Colchester County, Nova Scotia, and of the Scotia Diatom Products, Ltd., in Digby County. The former company has been operating since 1895.

QUICKSILVER — *Commerce Reports* for Aug. 13 contains a review of the international quicksilver situation, by Joseph S. McGrath, of the Minerals Division of the U. S. Department of Commerce. In conclusion, it is stated that in view of the estimated consumption in the United States during 1926 and 1927, the limited American output, the stocks in bond, the notable decrease in imports during the first half of 1928, and the report of accumulation of stocks in Spain and Italy, it would appear that prices have not been established in accordance with the economic law of supply and demand. The statistical position of mercury in recent months, however, has effected a downward trend in quotations in the American market.

HECLA HISTORY—A. C. Stevenson is the author of an article on the history of the Hecla mine that is running in installments in the *Compressed Air Magazine*. Part III appeared in the August issue. In it, Mr. Stevenson discusses what was done to restore electric service and to unwater the mine after the fire of a few years ago.

IRON ORE, IRON AND STEEL—The American Iron and Steel Institute, 75 West St., New York, has issued its annual statistical report for 1927. Besides the figures relating to iron, steel and ferro-alloys, the reports present the statistics of production and shipments of iron ore, coal and coke, likewise of average monthly and yearly prices.

ANTIMONY—*Commerce Reports* for July 16, 1928, contains a two-page article on the Mexican antimony industry, which is based on reports from the Consul at Mexico City, San Luis Potosi, and Nogales. The total production of the metal in Mexico in 1927 was 1894 tons, compared with 2,573 tons the year before.

COPPER SMELTER FLUE DUSTS—Serial No. 2871 of the U. S. Bureau of Mines is a paper entitled "Flue Dusts From Copper Smelters of the Southwest: Composition and Methods of Treatment." William A. Sloan, of the Tucson station, is the author. The paper is 40 pages long.

TOPOGRAPHIC SURVEYING—The U. S. Geological Survey has just issued Bulletin 788, entitled "Topographic Instructions of the U. S. Geological Survey." The bulletin is issued under the name of C. H. Birdseye, chief topographic engineer of the Bureau. It contains 432 pages.

NORTH AMERICAN GEOLOGY — The U. S. Geological Survey has issued a bibliography of North American Geology for the years 1925 and 1926. The author is John M. Nicols. The pamphlet is known as Bulletin 802 and contains 286 pages.

QUEBEC MINING — The Bureau of Mines of the Province of Quebec has issued its report for 1927 on mining operations in the province. The volume contains 246 pages. In it is a list of the principal operators and owners of mines and quarries in the province.

MARKET AND FINANCIAL NEWS

International Nickel Issues New Stock

DIRECTORS of International Nickel Company announce a new offering of stock to shareholders at the rate of $60 a share, one share of new stock to be offered for each ten shares held. In addition, shareholders of preferred stock will be given the right to purchase one share of new stock at $60 for each 2½ shares held. The new stock issue will place about $12,000,000 in the treasury, which together with the present cash reserves assures completion of the projected construction and will leave the company in its customary strong financial position.

Preferred and common stock shareholders of record Aug. 30, 1928, will be entitled to subscribe to the stock. Warrants will expire Sept. 20. The new stock may be paid for in full or in installments of $20 a share at the time of subscription, $20 on Dec. 28, 1928, and $20 on March 29, 1929. The money is required for a program which includes the development of the Frood mine, hydro-electric equipment, concentrator, additions to the smelting plant, and the installation of further electrolytic units at Port Colborne. The total amount required for these expenditures is approximately $18,000,000, of which $4,000,000 has already been spent and the remaining $14,000,000 will be required prior to 1931, by which time the new construction will be completed. Directors of the company considered it unfair to shareholders to withhold earnings for the purpose of financing extraordinary capital expenditures, and at the recent meeting decided to offer new stock for that purpose.

Canadian Production of Arsenic Increased in 1927

FINALLY revised statistics on the production of arsenic from Canadian ores in 1927 as reported by the Dominion Bureau of Statistics show an output of 6,227,968 lb., valued at $211,979 in 1927, compared with 5,074,677 lb., worth $146,811, in 1926. The average price of arsenic in New York during 1927 was 3.83c. per pound, against 3.50c. in 1926.

In Canada, arsenic is used in the manufacture of paris green, lead arsenate, lime arsenate, sheep dips, and other insecticides. Other uses are found in the manufacture of glass and, to a small extent, in medicinal and pharmaceutical preparations.

The greater part of the Canadian production of arsenic is obtained from the south Ontario smelters as a byproduct in smelting silver-cobalt ores. A small amount is contained in the speiss residues exported by these smelters. British Columbia's annual production of arsenic is contained in concentrates shipped from the Nickel Plate gold mine to the Tacoma smelter. Nova Scotia's output in 1927 was contained in concentrates recovered from tailings taken from the dump at the Boston-Richardson property, at Goldboro. These concentrates were shipped to Australia.

STATISTICAL NOTES

AMERICAN POTASH & CHEMICAL CORPORATION, producing potash and borax from the brines of Searles Lake, in San Bernardino County, Calif., has declared its initial dividend, of 50c. per share of capital stock, payable Sept. 29 to stockholders of record Sept. 21. The company is now the world's largest producer of borax.

HECLA MINING COMPANY, silver-lead producer of the Coeur d'Alene district, Idaho, reports net profit of $348,638 for the second quarter of 1928, as compared with $364,535 in the quarter ended March 31, 1928. Results of operation for the two periods are compared in the following table:

	1928	
	First Quarter	Second Quarter
Gross income	$919,251	$886,496
Operating expenses	$400,716	$413,293
Taxes accrued	83,000	56,000
Depreciation	70,999	68,565
Total expenses	$554,716	$537,858
Net profit	$364,535	$348,638
Tons ore mined	80,183	80,065
Pounds lead produced	16,127,183	15,148,145
Ounces silver produced	497,996	449,391

BUTTE & SUPERIOR MINING COMPANY reports net income to surplus of $21,827 in the second quarter of 1928, compared with $39,893 in the first quarter of the current year. Metal production for the two periods is compared in the following table:

	1928	
	First Quarter	Second Quarter
Copper, lb.	510,055	256,832
Zinc, lb.	21,266,354	16,037,059
Silver, oz	579,410	460,054

The decrease in production is attributed largely to a seasonal labor shortage and the gradual depletion of minable ore reserves, which, as to known copper ores, will be completely exhausted during the third quarter.

Production of Utah Copper Increases in Second Quarter

PRODUCTION of the Utah Copper Company in the second quarter of this year, according to the company's report issued Aug. 13, amounted to 60,591,239 lb. of copper, an average of 20,197,080 lb. a month. In the first three months the output was 55,604,174 lb., an average of 18,534,725 lb. a month. During the last quarter the Arthur mill treated 1,757,200 dry tons of ore, and the Magna mill 1,770,700 dry tons, a total of 3,527,900 dry tons for both mills.

The average grade of ore treated at the mills was 0.97 per cent copper, and the average mill recovery of copper in the form of concentrates was 89.50 per cent of that contained in the ore. For the preceding quarter the ore averaged 0.96 per cent copper and the recovery made was 86.58 per cent.

Average cost per pound of net copper produced, including depreciation of plant and equipment, and all fixed and general expenses, and after crediting gold, silver, and miscellaneous earnings, was 7c., compared with 7.6c. for the preceding quarter.

Semi-annual statistics show that during the first six months of 1928 the mills of the company treated a total of 6,969,900 tons of ore and recovered 116,195,413 lb. of copper in the form of concentrates. In the same period of last year 7,232,500 tons of ore was treated, and 121,808,874 lb. of copper recovered in the form of flotation concentrates.

Metal Production Statistics of the Central States for 1927

The U. S. Department of Commerce reports mine production of silver, copper, lead, and zinc in the Central States in 1927, according to the following table:

State	Silver, Ounces	Copper, Pounds
Illinois	1,518	
Michigan	97,193	166,146,437
Missouri	233,931	451,000
Total, 1927	332,642	166,597,437
Total, 1926	198,232	176,458,565

	Lead, Tons	Zinc, Tons
Arkansas	23	128
Illinois	277	521
Kansas	27,497	109,427
Kentucky	139	860
Missouri	198,760	18,737
Oklahoma	51,680	206,611
Wisconsin	2,069	32,841
Total, 1927	280,445	369,125
Total, 1926	307,456	456,194

Canada's 1927 Gold Production Established New Record

CANADA'S gold production in 1927 again established a new high record, with a total of 1,852,785 oz., against the 1926 production of 1,754,228 oz., according to a report issued by the Dominion Bureau of Statistics at Ottawa.

Production from Nova Scotia mines at 3,151 oz. was nearly double that of 1926, owing to the increased activity in gold mining in that province and because of shipments to Australia of concentrates containing arsenic and gold.

The Quebec output of 8,331 oz. shows an increase of over 100 per cent, as a result of the increase in the production of the silver-lead-zinc ores which carry gold and the production of gold in blister copper at the Noranda smelter during the last two weeks of December, 1927.

Ontario produced 1,627,050 oz. in 1927, against 1,497,215 in 1926. The Porcupine area showed a slight increase over the record for the previous year; Kirkland lake area produced 35 per cent more than in 1926; and the amount of gold recovered from the nickel-copper ores of the Sudbury district was greater also.

Manitoba production at 182 oz. was about the same as in the previous year, but greater activity in development and prospecting was much in evidence.

British Columbia's output, at 183,094 oz., decreased 19 per cent from the production of 1926. Though production of alluvial gold was normal in the Atlin district, the output from the Cariboo district was considerably reduced, because the Kafue Copper Development Company's dredge was not producing in 1927. Gold in gold bullion and blister copper was less, but gold in ores exported was greater. A considerable part of the gold production comes as a byproduct of copper and silver mining and is subject to yearly variations according to the grade of ore mined.

Yukon production amounted to 30,925 oz., consisting of 30,778 oz., of alluvial gold and 157 oz. in ores exported.

Production of Gold in Canada by Provinces and by Sources, 1926 and 1927

	1926 Ounces	1927 Ounces
Nova Scotia		
In gold bullion and in concentrates exported	1,678	3,151
Quebec		
In blister copper and in ores exported	3,680	8,331
Ontario		
Porcupine area:		
In gold bullion	1,145,479	1,153,034
In slags exported	94	1,086
Kirkland lake area:		
In gold bullion	345,462	466,113
In slags exported	1,509	1,895
Sudbury area:		
In matte and blister copper exported	4,447	4,866
Miscellaneous	224	56
Total	1,497,215	1,627,050
Manitoba		
In gold bullion	188	182
Alberta	.....	42
British Columbia		
In alluvial gold	16,730	7,353
In gold bullion	25,312	16,620
In blister copper	58,659	30,141
In base bullion and in ores exported	125,165	128,980
Total	225,866	183,094
Yukon		
In alluvial gold	25,344	30,778
In ores exported	257	157
Total	25,601	30,935
Total Canada	1,754,228	1,852,785

Central Eureka Sells Preferred Stock

CENTRAL Eureka Mining Company, of Sutter Creek, California, after collecting two assessments during the fiscal year ended April 26, 1928, has definitely embarked upon a new plan for financing the unwatering and development of its Old Eureka property, now opened to the 1,800 level. Present capital stock of 600,000 shares has been divided into 200,000 shares (treasury stock) preferred and 400,000 shares (issued) common. Preferred has been placed with a syndicate at $1.25 per share, the issue of preferred being paid for in installments of approximately 30,000 shares per month. Preferred shares have a preference of 6 per cent dividends on par value of $1 per share, but are not cumulative and have no preference in assets. The sale of the preferred stock will place ample funds in the company's treasury for the development of new ground.

During the year ended March 31, 1928, the tonnage milled was 56,774 and gold recovery was $449,579. Total development was 3,534 ft. The Central property is now at a depth of 4,700 ft. on the incline.

HARVIE MINING, which a couple of years ago came into public notice through an extensive advertising campaign, has been thrown into liquidation, and creditors are ordered to meet in Montreal on Aug. 30, 1928. At one time the company had several hundred thousand dollars cash on hand but practically none of this is left. Subsidiary companies, Cycline Rapids Mining and Exploration Company of Canada, were formed to carry on operations in other fields. The company has practically no cash on hand and debts amount to over $20,000, in addition to $50,000 loaned by the present directors, who a few months ago took over the direction of the company from the former executives.

SANTA GERTRUDIS COMPANY, LTD., operating in the Pachuca district of Mexico, reports total revenue for the quarter ended June 30, 1928, as $459,489, before deducting allowances for depreciation or depletion. A total of 163,250 tons of ore was milled during the period, with operations proceeding at plant capacity. Of the ore milled 77,152 tons came from the Inversiones Company's properties and 86,098 tons from the properties of Compania Dos Carlos.

Analysis of Productive Operations Index

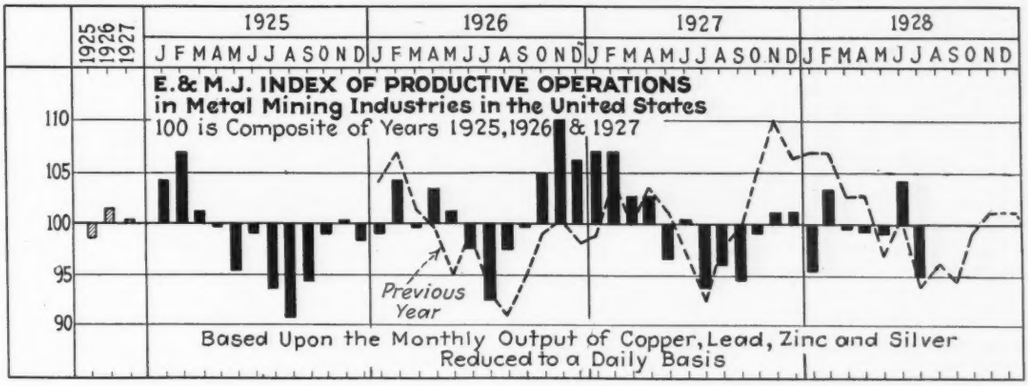
THE decline in *E. & M. J.* Index of Productive Operations for July is directly in line with a seasonal-trend established precedent of recent years. Reference to the chart on page 357 confirms this statement. In 1925 and 1926, the July Index Number was 5.2 points below that of June; in 1927 the recession amounted to 6.6; and this year it is 9.2 points. Incidentally, this 9.2 point recession is the largest monthly variation thus far recorded on the chart. This month's decline is of particular interest, following as it does the acknowledged intent of the copper producers to let out the tension, occasioned by the recent increase in copper demand, by stepping up production somewhat. Either their intention was completely satisfied by the increases registered in April, May, and June; or their desire further to increase production last month was not sufficient to overcome the usual midsummer production-decreasing factors. Of these factors the more important appear to be: (1) tendency of the Western farming and crop-harvesting labor requirements to draw upon the migratory portion of mine, mill, and smelter working forces; (2) shortage of man-power, technical as well as unskilled labor, because of vacations, lay-offs for hunting or fishing trips, and the loss of time over the Fourth of July holiday period; (3) decrease in physical and mechanical efficiency, particularly in the Southwest, because of hot weather and generally less satisfactory working conditions. The daily rate of copper smelter production declined 241 tons in July. Of this decline, 62 per cent, or 150 tons, is accounted for by smelters in the Southwest, which in 1927 produced approximately 41 per cent of the production of United States smelters. This comparison will serve to indicate the relative effect of the midsummer production-decreasing factors, mentioned above, on output at the Southwest copper smelters.

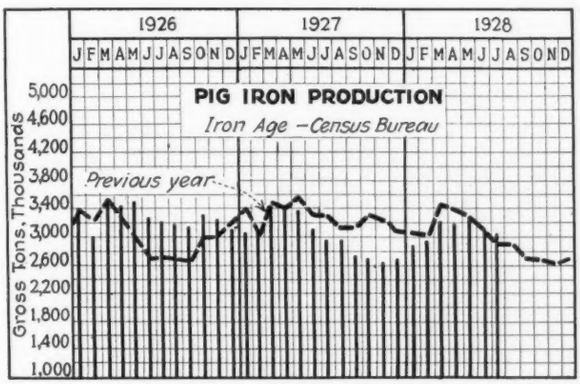
The daily rate of silver production in the United States declined from 165,000 oz. in June, to 139,000 oz. in July. No explanation for this large drop is readily forthcoming. True, the average for the two months is not far from the average for April and May, but copper and lead refineries, the source of the greater part of this production, maintained output at a fairly even rate throughout both months, and it would appear that the variation must have resulted from changes in production rates by some of the primary producers.

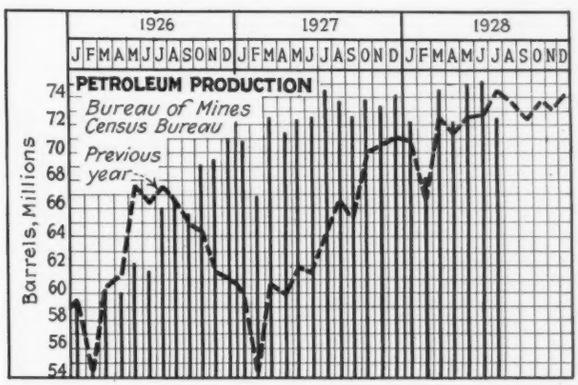
United States pig-lead production for July is 150 tons per day less than in June. Gross production of slab zinc in the United States increased slightly in July. However, when reduced to a daily basis, a decline from June of 52 tons per day is registered.

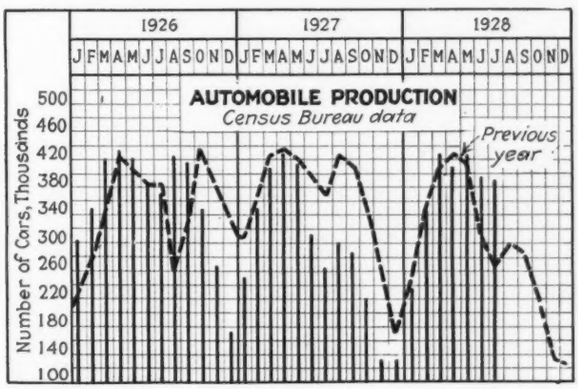
Indicators of Industrial Activity

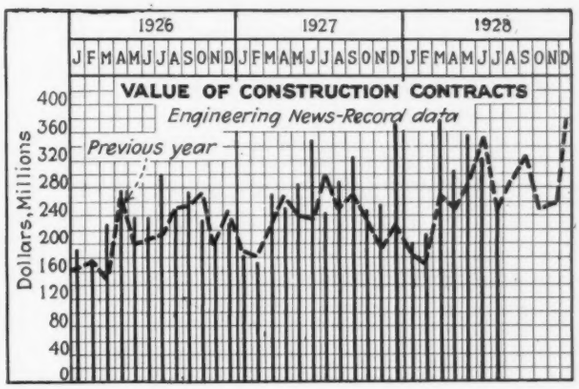
of Significance to Mining

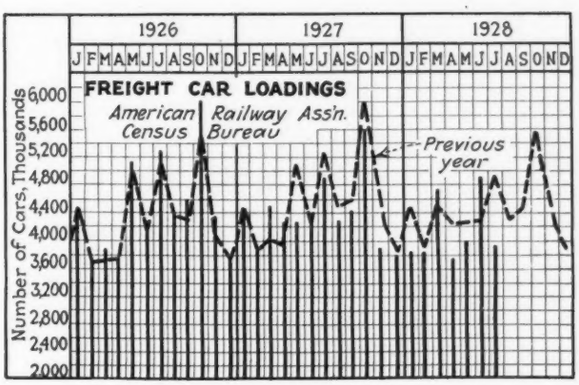


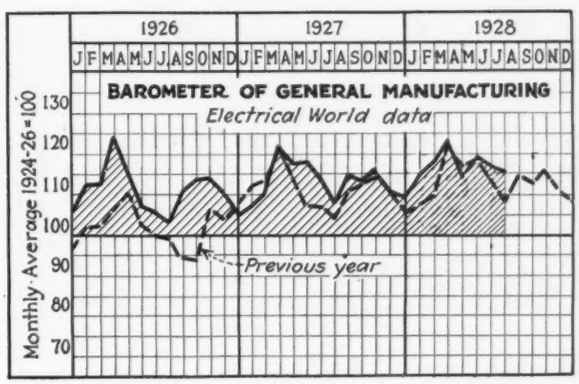












The Market Report

Lead Prices Advance, With Heavy Sales—Copper and Zinc Steady

New York, Aug. 29, 1928—Active buying of lead was again the feature of the domestic markets in non-ferrous metals. Two advances in the price, bringing it to 6.40c., New York, served only to whet the appetites of consumers, and the volume of sales in the aggregate exceeded the exceptional record of the preceding week. Copper was rather quiet, but some business was done each day, and the price was firmly maintained at 14.75c., Connecticut. A normal turnover of zinc is reported, with the price unchanged at 6.25c., St. Louis. Tin sagged somewhat, and in London the backwardation continues, indicating weakness in the position. Silver, as a result of weakness in both China and India, declined, but has recovered part of the loss, with 58¾c. quoted today.

Daily Prices of Metals

Aug.	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
23	14.525	48.00	6.30	6.10	6.25
24	14.525	47.25@47.375	6.30	6.10@6.20	6.25
25	14.525	47.25@47.375	6.30	6.10@6.20	6.25
27	14.50@14.525	47.00@47.125	6.40	6.175@6.25	6.25
28	14.525@14.55	47.625	6.40	6.20@6.225	6.25
29	14.525	47.625	6.40	6.225	6.25
	14.525	47.490	6.350	6.175	6.250

Average prices for calendar week ending August 25, 1928, are: Copper, 14.525; Straits tin, 47.688; N. Y. lead, 6.250; St. Louis lead, 6.075; zinc, 6.254; and silver, 58.833.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis: that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted, and prices at so-called Middle West destinations, 0.325c. above.

Quotations for copper are for the ordinary form of wire bars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Aug.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
23	62 9/16	63	68¾	212½	209¼	22	21 7/8	24½	24⅝
24	62⅝	63	68¾	211	207	22	21⅞	24 7/16	24 9/16
27	62⅝	63	68¾	208¾	205½	22 1/16	21⅞	24½	24 9/16
28	62 9/16	62 15/16	68¾	210	206¾	22	21⅞	24⅝	24 11/16
29	62 7/16	62 13/16	68¾	209⅛	206¾	22⅛	21⅞	24¾	24¾

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Aug.	Sterling Exchange "Checks"	Silver		Gold London	Aug.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
23	4.84 7/8	58⅞	27⅛	84s11½d	27	4.84 7/8	58½	26 13/16	84s11½d
24	4.84 7/8	58⅝	27	84s11½d	28	4.84 7/8	58½	26 13/16	84s11½d
25	4.84¾	58⅝	26 15/16	... ...	29	4.84 7/8	58¾	26	84s11½d
						Avg.	58.646		

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pense per troy ounce of sterling silver, 925 fine. Sterling quoations represent the demand market in the forenoon. Cables command three-eighths cent premium.

Little New in Copper Situation

Another week of comparative quiet in the copper market finds the situation unchanged so far as prices are concerned. Practically all of the business was done at 14.75c., Connecticut, with some "District 3" business at 14.875c. and a few sales for delivery close to the refinery passing at slight concessions from the Connecticut basis. Quite a tonnage was placed for September delivery, indicating that consumers had not covered their requirements for that month. In fact, there is reason to believe that still more September copper remains to be purchased. Producers interpret the position as indicating that consumers are confident that the steadiness in the price is likely to continue and that they are not worrying about getting copper when they need it. Foreign sales for the month will be in the neighborhood of 45,000 short tons, all at the exporters' price of 15c. c.i.f. Foreign consumers, according to the statistics of the producers, must still buy a good tonnage of September metal.

Statistics of the A. B. M. S. show an increase of 61,800 tons in the estimated world production of copper for the first six months of 1928, compared with the corresponding period of 1927. This is 7.4 per cent. So far the world has been able to absorb this additional production. The fact that the increases are in countries—Chile, Peru, the Congo, and Canada—where new producers have entered the picture recently, suggests that the production may increase still more in the second half of the present year.

Lead Activity Continues at Higher Prices

Two advances in the contract price of the A. S. & R. Co. for New York lead failed to dampen the ardor of buyers, for the metal, and as a result the volume of sales for the week established a new record for the year, surpassing by a comfortable margin the record of the preceding week. The advances in the smelting company's contract price were from 6.20c. to 6.30c. per pound on last Thursday, Aug. 23, and from 6.30 to 6.40c. per pound on Monday, Aug. 27. All sales in the eastern market have been on the basis of the A. S. & R. Co.'s contract price. In East St. Louis, however, the price advance has been less regular. A considerable volume of lead changed hands on the morning of Aug. 23, at 6.10c. per pound; since then prices have been higher, but until today considerable variation has existed between the quotations of the various sales agencies. Today, the price appears firmly established at 6.225c. per pound for early delivery. Some lead, for October delivery, has brought 6.25c., and at least one large interest is inclined to ask that price for all forward metal. Inquiries have been received for November lead, but in none

of the sales reported has delivery that far in advance been agreed upon. However, a backwardation of approximately 5s. per long ton for futures under spot pig lead exists in London, indicating that the outlook is not viewed in quite so favorable a light by those on the other side. Prompt and early September deliveries have been the basis of 90 per cent of the last week's business, though some have inquired for futures.

Zinc Steady at 6.25c.

A normal week's business in zinc, with the price steady at 6.25c. St. Louis, is reported. Apparently, the sale at 6.30c. on which was based the range from 6.25 to 6.30c. in our quotation for Wednesday a week ago, was irregular in some respect, for plenty of metal seems to have been available at the lower figure. The New York price continues at 6.60c. for Prime Western, and for High-Grade 7.75c. is asked for spot carload lots. The price is largely nominal, however.

Little Change in Tin

Though the average price of Straits tin for the current *E. & M. J.* week is approximately ½c. per pound below that of the preceding week, business has been good and the market situation continues virtually unchanged. Spot tin has been in strong demand during the last few days, as stocks in the New York area are depleted, except for a small tonnage in the hands of one interest, who holds strict control of the present situation.

Silver Lower and Quiet

Weakness on the part of India and China has depressed silver during the last week, and the decline carried prices down to 26⅛d. in London and 58½c. in New York, the lowest level reached since May 5. The market closes quiet and uncertain.

Mexican Dollars (Old Mexican pesos): Aug. 23d, 44⅜c.; 24th and 25th, 44½c.; 27th and 28th, 44⅛c.; 29th, 44⅜.

Foreign Exchange Firm

Foreign exchanges have been firm, lire and marks having advanced slightly during the week. Sterling remains unchanged. Closing cable quotations for Tuesday, Aug. 28, were as follows: francs, 3.90⅛c.; lire, 5.24⅝c.; and marks, 23.84c. Canadian dollars, ⅛ per cent premium.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c.

ANTIMONY—Per lb., duty paid, New York; Chinese brands, for all positions 10¼@10⅜c. Cookson's "C" grade, spot, 15⅜c.

BISMUTH—Per lb., New York, in ton lots, $1.70. Smaller lots, $1.85 and up.

CADMIUM—Per lb., New York: 70 @80c., according to quantity.

IRIDIUM — Per oz., $280@$300 for 98@99 per cent sponge and powder. Market dull.

NICKEL—Per lb. ingot, 35c.; shot, 36c.; electrolytic, 37c. (99.9 per cent grade) for single lots of spot metal.

PALLADIUM — Per oz., $42@$47. Small lots bring up to $50. Market very dull.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $78. Dealers and refiners quote the trade for refined metal, per oz., cash, for wholesale lots, $74@$74.50 bid, $75.50@$76.50 asked. Nominal.

QUICKSILVER — Per 76-lb. flask, $125. Small lots command a slight preminum. Market firm. San Francisco wires $127.

Prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of Aug. 4.

Metallic Ores

MANGANESE ORE—Per long ton unit of Mn, c.i.f. North Atlantic ports, minimum 47 per cent Mn; 35@38c. Caucasian, washed, 53@55 per cent, 38@40c. Chemical grades unchanged from quotations in the Aug. 4 issue.

TUNGSTEN ORE—Per unit of WO_3, N. Y.; Wolframite, $10.75@$11, Western scheelite, $10.75@$11.

Chrome, Iron, Tantalum, and Titanium ores are unchanged from quotations in the Aug. 4 issue.

August Tri-State Production Increased 6,000 Tons

Joplin, Mo., Aug. 25, 1928

Blende	Per Ton
High	$43.25
Premium blende, basis 60 per cent zinc	$40.00@ 41.00
Prime Western, basis 60 per cent zinc	40.00
Fines and slimes, 60 per cent zinc	37.00@ 40.00
Average settling price, all zinc	40.48
Galena	
High	$82.30
Basis 80 per cent lead	80.00
Average settling price, all lead	81.26

Shipment for the week: Blende, 10,261; lead, 1,470 tons. Value, all ores the week, $534,820.

Shipment for eight months: Blende, 385,192; lead, 60,200 tons. Value all ores eight months, $19,670,060.

No renewed restriction of the output is yet in evidence and stocks in bins increased 6,000 tons during August.

Buyers do not need and do not buy all of the ore offered for sale, and, though the bulk of unsold ore is a reserve held in check, an increasing tonnage is produced that will eventually force producers to accept a lower level of prices. At present, however, buyers are enabled to obtain ore on a closer classification of grades, and the less desirable ore is in the accumulating stock.

Platteville, Wis., Aug. 25, 1928.

Zinc Blende	Per Ton
Blende, basis 60 per cent	$42.75
Lead Ore	
Lead, basis 80 per cent	$81.00

Shipments for the week: Blende, 539 tons; lead, none. Shipments for the year: Blende, 24,063 tons; lead, 1,405 tons. Shipments for the week to separating plants, 1,109 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, and Tripoli are unchanged from prices in the Aug. 4 issue.

Metallic Compounds

ARSENIOUS OXIDE (White Arsenic)—Per lb., 4c.

CALCIUM MOLYBDATE or MOLYTE—Per lb. of contained Mo, 95c. delivered.

Antimony Oxide, Copper Sulphate, Sodium Sulphate (Salt Cake), Sodium Nitrate, and Zinc Oxide are unchanged from prices in the Aug. 4 issue.

Alloys

FERROMANGANESE—Per long ton, domestic and foreign, f.o.b. furnace or duty paid, port of entry, $105 quoted for last half, 1928. Spiegeleisen, 19@21 per cent, $33 f.o.b. furnace.

FERROMOLYBDENUM—Per lb. of Mo, f.o.b. shipping point, 50@60 per cent Mo, $1.20@$1.25. One producer quotes $1.20 on both large and small quantities.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent, 96@98c. f.o.b. works.

Ferrocerium, Ferrochrome, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrovanadium, Monel Metal, Nickel Silver and Yellow (Muntz) Metal are unchanged from prices in the Aug. 4 issue.

Rolled Metals

Copper, Lead, and Zinc Sheets are unchanged from prices in the Aug. 4 issue.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the issue of Aug. 4.

Iron, Steel, and Coke

Iron—Per gross ton, Valley furnaces, Bessemer, $17; basic, $16@$16.50; No. 2 foundry, $16.50@$17.

Steel—Base prices per gross ton, Pittsburgh, billets and slabs, $33; plates, structural shapes, and soft steel bars, per pound, 1.85@1.90c.

Coke—Per gross ton. Connellsville furnace, contract, $2.75@$3; spot, $2.50@$2.75. Connellsville foundry, contract, $3.50@$4.85; spot, $4@$4.85. By-product coke, Ohio and Kentucky, $7; Buffalo and Detroit. $8.50@$9.

Mining Stocks—Week Ended August 25, 1928

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	72	66	71⅛	Jl.14, Au. 20 Q	1.00
Ariz. Com'l	Boston	4¼	4	4¼	Jl. 16, Jl. 31 SA	0.25
Cal. & Ariz	New York	103¾	96½	102⅝	Se. 7, Se. 24 Q	1.50
Calumet & Hecla	Boston	27½	23½	27	Au. 31, Se. 15 Q	0.50
Cerro de Pasco	New York	78⅞	76½	78	Jl.12, Au. 1 Q	1.25
Chile Copper	New York	48⅛	44⅛	45⅝	Se.15 Se.29 Q	0.62½
Con. Coppermines	N. Y. Curb	12¼	10⅝	12		
Copper Range	Boston	19½	17½	19½	Mr. 24, Ap. 20 A	1.00
Crystal Copper	Boston Curb	*45	*34	*42		
East Butte	Boston	2¼	2	2¼	Dec., 1919	0.50
Granby Consol	New York	59½	54⅛	59½	Jl.13, Au.1 Q	1.00
Greene Cananea	New York	119⅜	100⅛	119	Se. 14, Oc.1 Q	1.00
Howe Sound	New York	59⅞	56½	59	Je.30, Jl. 16, Q	1.00
Inspiration Consol	New York	22⅝	20⅛	22¼	Apr. 1927 Q	0.25
Isle Royale	Boston	20⅛	18⅝	20⅛	Au.31, Se.15SAX	0.75
Kennecott	New York	98	95¼	97¼	Au.31, Oc 1 Q	1.50
Magma Copper	New York	52⅜	49¼	51⅜	Jl.29, Jl.16 Q	0.75
Mason Valley	N. Y. Curb	1⅜	1⅜	1⅜		
Miami Copper	New York	22	21	21⅜	Au.1, Au.15, Q	0.37½
Mohawk	Boston	58	56½	57	Jl. 31, Se. 1 Q	1.00
Montana-Idaho	Spokane	*16	*14½	*15¼		
Mother Lode Coal	New York	2⅜	2⅛	2⅛	Je.8, Je. 30, SA	0.15
Nevada Consol	New York	26⅜	24	26	Je.15, Je.30 Q	0.375
New Cornelia	Boston	28	27⅜	28	Au.3, Au. 20 Q	0.50
Noranda	N. Y. Curb	56½	52⅛	54⅞		
North Butte	Boston	4	3⅜	3⅞	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*75	*67	*74	Sept., 1926	0.03
Old Dominion	Boston	15	13⅜	15	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb	143	139	142½	Je.25, Jl.22 Q	2.00
Quincy	Boston	39	36½	39	March, 1920	1.00
St. Mary's Min. Ld	Boston	29½	26½	29½	Ap.1928 A	2.00
Seneca Copper	New York	2½	2⅜	2⅜		
Shattuck-Denn	N. Y. Curb	17⅜	17⅛	17⅛		
Tenn. C. & C	New York	15⅞	14⅛	15⅛	Au., 31 Se.15,Q	0.25
United Verde Ex	N. Y. Curb	15	14½	14⅞	July 6, Q	0.50
Utah Copper	New York	...	...	170	Je.15, Je.30 Q	1.50
Utah Metal & T	Boston	1⅛	1⅛	1⅛	Dec., 1917	0.30
Walker Mining	Salt Lake	1.20	1.17½	1.20		
NICKEL-COPPER						
Internat. Nickel	New York	105	99½	104½	Se.10, Se.29 Q	0.75
Internat. Nickel pfd	New York	124	123	123½	Jl.12, Au.1 Q	1.50
LEAD						
Gladstone Mtn	Spokane	*5⅛	*4⅛	*4¼	June, 1927	0.005
National Lead	New York	125¼	120	124	Se.14, Se.29 Q	1.25
National Lead, pfd. A	New York	...	...	144½	Au.31, Se.15 Q	1.75
National Lead, pfd. B	New York	...	...	122	Oc. 19, No.1 Q	1.50
St. Joseph Lead	New York	43½	41½	43	Je.9, Je.20, QX	0.75
ZINC						
Am. Z. L. & S	New York	27⅞	26⅞	27	May, 1917	1.00
Am. Z. L. & S. pfd	New York	86⅛	85	86	Nov., 1920	1.50
Butte C. & Z	New York	9⅛	7	9	Dec., 1926	0.50
Butte & Superior	New York	11⅜	9	10½	Je.15,Je.30 Q	0.50
Callahan Zn-Ld	New York	3½	2⅛	2⅞	De., 1920	0.50
Consol.Lead&Zinc 'A'	St. Louis	14½	13	13	Je.25, Jl.1 Q	0.25
Eagle-Picher	Cincinnati	18⅛	17⅛	17⅛	No.15, De.1 Q	0.40
Eagle-Picher pfd	Cincinnati	...	...	100	July 15 Q	1.50
New Jersey Zn	N. Y. Curb	218	218	218	Jl. 20, Au. 10 X	2.00
Treadwell-Yukon	Toronto	17	16	17		
United Zinc	N. Y. Curb	*75	*65	*75		
Yellow Pine	Los Angeles	*25	*25	*25	Dec., 1925 QX	0.04
GOLD						
Alaska Juneau	New York	3⅜	3⅛	3⅜		
Ankerite	Toronto	...	...	*25		
Barry-Hollinger	Toronto	*49	*36½	*44		
Central Manitoba	Toronto	*95	*85	*90		
Cresson Consol. G	N. Y. Curb	*95	*91	*95	Je.30, Jl.10 Q	0.10
Dome Mines	New York	8¼	8⅛	8⅛	Je.30, Jl.20 Q	0.25
Golden Cycle	Colo.Springs	†1.71	†1.69½	...	My. 31, Je.10 Q	0.04
Gold Hill	Toronto	*15¾	*10½	*13		
Hollinger Consol	Toronto	10¼	9	9	Au. 22, Se. 15 M	0.10
Homestake Mining	New York	74	74	74	Au.20, Au.25 M	0.50
Kirkland Lake	Toronto	1.50	1.43	1.48		
Lake Shore	Toronto	23.25	20.15	23.00	Se.1, Se.15, QX	0.20
McIntyre Porcupine	New York	21⅛	20⅛	20⅛	Au.1, Se.1 Q	0.25
Portland	Colo.Springs	†*21	†*19½	...	Ap., 1927	0.02
Rand Mines	New York	...	...	39½	Au.21-28 Am.Sh	1.52
Sylvanite	Toronto	2.45	2.43	2.45		
Teck-Hughes	Toronto	9.35	9.00	9.20	Jl. 17, Au. 1 SAX	0.15
Tom Reed	Los Angeles	*54	*40	*52	Dec., 1926	0.02
Tough-Oakes	Toronto	*31	*22½	*30		
Vipond Cons	Toronto	*46	*44½	*46	April, 1927	0.03
Wright-Hargreaves	Toronto	3.50	3.40	3.50	Jl.16, Au.1 Q	0.02½
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb	...	...	17¾		
Con. Cortez	N. Y. Curb	*22	*22	*22		
Dolores Esperanza	N. Y. Curb	1⅛	1⅛	1⅛	July, 1923	0.05
N.Y. Hond's Rosario	N. Y. Curb	...	...	15	Jl.18, Jl.28 Q	0.50
Premier Gold	N. Y. Curb	2⅜	2 1/16	2⅛	Je.14, Jl.3 Q	0.06
Tonopah Belmont	N. Y. Curb	1	*90	*90	Oc., 1925	0.05
Tonopah Extension	N. Y. Curb	*11	*10	*10	Ap., 1925	0.05
Tonopah Mining	N. Y. Curb	4⅜	4	4⅜	Mar.31,Ap.21 SA	0.07½
West End Consol	N. Y. Curb	...	...	*5	Mar., 1923	0.05
Yukon Gold	Boston Curb	...	...	*66	June, 1918	0.02
SILVER						
Beaver Consol	Toronto	*83	*77	*83	May, 1920	0.03
Castle-Trethewey	Toronto	*46	*44	*46		
Coniagas	Toronto	4.50	4.50	4.50	May, 1924	0.12½
Keeley	Toronto	*45	*45	*45	Mr.1, Mr.15 SA	0.04
Lorrain Trout Lake	Toronto	...	...	*50	July, 1925	0.05
Mining Corp. Can	Toronto	3.44	3.22	3.44	My.20, Je.13 SA	0.125
Nipissing	N. Y. Curb	3⅜	3⅜	3⅜	Je.30, Jl.20Q	0.075

Stock	Exch.	High	Low	Last		Last Div
SILVER-LEAD						
Ahumada	New York	3	2⅞	3	Ap., 1927	0.12½
Bingham Mines	Boston	48½	46⅝	48⅛	Jl.31, Au.4 Q	1.00
Bunker Hill & Sullivan	N. Y. Curb	129¼	129¼	129¼	Au.31, Se.4 MX	0.75
Cardiff M. & M	Salt Lake	*58	*55	*55	Feb. 5, 1927	0.10
Chief Consol	Salt Lake	3.90	3.55	3.75	Ja.10, Fe.1 K	0.10
Consti'n Mng.&Mill'g.	Spokane	*35	*24	*35		
Erupcion	Boston Curb	*21	*21	*21	Dec. 13, Jan. 3,	0.07½
Eureka Lily	Salt Lake	1.82½	1.70	1.82½		
Federal M. & S	New York	126	126	126	Je., 1927	10.00
Federal M. & S. pfd	New York	...	...	98	Au. 24, Se. 15 Q	1.75
Golconda	Spokane	1.12½	1.10	1.10		
Hecla Mining	N. Y. Curb	15⅜	14⅞	15	Au.15, Se. 1 Q	0.15
Highland-Surprise	Spokane	*10½	*9	*9		
Iron King Mining	Salt Lake	*85	*83	*83		
Keystone Mining	Salt Lake	†*35	†*20	...	Fe., 1926	0.07½
Lucky Jim	Spokane	*28	*27	*27		
Lucky Tiger-Com	Kansas City	†7.10	†6.90	...	Au.10,Au.20 M	0.05
Mammoth Mining	Salt Lake	1.75	1.40	1.40	De., 1926	0. 25
North Lily	Salt Lake	7.40	7.30	7.35		
Park Utah	New York	10⅜	9⅞	10⅛	Je.15, Jl.2 Q	0.20½
Plutus Mining	Salt Lake	1.50	1.40	1.40	Ap.10, Ap.16 Q	0.10
Rico-Argentine	Salt Lake	*50	*47	*50	June 15 Q	0.03
Sherman Lead	Spokane	*25½	*23	*23		
Silver King Coal	Salt Lake	13.75	13.37½	13.37½	Je.20, Jl.2 Q	0.25
Silversmith	Spokane	*10	*8	*9¼	Oct., 1926 Q	0.02
Strattons Mines	Spokane	1.25	1.01	1.20		
Sunshine M. Co	Spokane	1.45	1.42	1.43	June 20, K	0.02
Tamarack-Custer	Spokane	*45	*42	*43½	Sept., 1924	0.25
Tintic Standard	Salt Lake	13⅞	13⅜	13⅞	Je.18, Je.30 QX	0.30
Utah-Apex	Boston	3⅞	3⅜	3⅜	Jl.14, Au.1 K	0.25
IRON						
Bethlehem Steel	New York	62½	59⅞	62½	Jl., 1924	1.25
Cleveland-Cliffs Iron	Cleveland	120	112½	119	Jl.14, Jl.25. Q	1.00
Colorado F & I, pfd	New York	63⅞	61	62	Au.10, Au.25 Q	2.00
Gt. North'n Iron Ore	New York	22¼	21	21⅛	Ap. 9, Ap. 30 K	0.75
Inland Steel	New York	65½	63⅜	64½	Au. 15, Se.1 Q	0.62½
Republic I. & S	New York	65⅜	63	64⅜	Au. 14, Se. 1 Q	1.00
Republic I. & S. pfd	New York	107½	107	107	Se. 15, Oc. 1 Q	1.75
Sloss-Sheffield S. & I	New York	113	113	113	Je.9, Je.20 Q	1.50
Sloss-Snef. S.&I. pfd	New York	....	....	105	Je. 20, Jl. 2 Q	1.75
U. S. Steel	New York	152⅜	147⅞	151⅛	Au.30, Se.29 Q	1.75
U. S. Steel, pfd	New York	141	140⅛	140⅜	Au. 6, Au. 30 Q	1.75
Virginia I. C. & C	New York	....	....	27	Jan., 1924	1.50
Virginia I.C.&C. pfd	New York	....	....	50	Je. 16, Jl. 2 SA	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol	New York	....	....	24⅛	Ju.16, Ju.26 K	0.97
So. Am. G. & P.	N. Y. Curb	3⅜	3⅛	3⅜		
Alum. Co. of Amer	N. Y. Curb	139	137½	139		
Alum. Co. of Amer. pf.	N. Y. Curb	....	....	108	Je. 15, Jl. 1 Q	1.50
Vanadium Corp	New York	75	72⅛	74⅛	Au. 1, Au. 15 Q	0.75
Patino M. & E.	New York	34⅜	32¾	33⅞	April, 1928	4s.
ASBESTOS						
Asbestos Corp	Montreal	29	25	28½	Jan., 1926	1.50
Asbestos Corp. pfd	Montreal	90	89	89½	Jl. 30, Jl. 16 Q	1.75
SULPHUR						
Freeport Texas	New York	66⅞	62½	66	Jl.14,Au.1 QX	1.75
Texas Gulf	New York	72⅞	68⅜	72	Se. 1, Se 15 Q	1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	48⅛	47	48	Au. 21, Se 1 Q	0.75
Amer. Metal, pfd. 6%	New York	....	....	109	Au.15, Se.1 Q	1.50
Amer. Met. pfd. 7%	New York	....	....	125	My.15, Je.1	1.75
Amer. Sm. & Ref	New York	240½	212½	238	Jl 13, Au.1 Q	2.00
Amer. Sm. & Ref. pfd	New York	135½	134¼	135	Au. 3, Se. 1 Q	1.75
Consol. M. & S	Montreal	250	244	248	Je.30, Jl.16 SAX	6.25
Newmont Mining	N. Y. Curb	162⅞	156	162½	Je.30, Jl.16 Q	1.00
U. S. Sm. R. & M	New York	51⅛	46½	50⅜	Jl. 5, Jl. 14 Q	0.87½
U.S. Sm. R.&M. pfd	New York	54⅛	54½	54½	Jl. 5, Jl 14 Q	0.87½

*Cents per share. †Bid or asked. Q, Quarterly. A, Annual. SA, Semi-annually. M, Monthly. FW, four weeks. K, irregular. I, Initial. X, Extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED August 14, 1928

Name	High	Low	Last	Date	Amount	Last Div.
Alaska Mexican ($5)	35/6	35/—	35/—			
Alaska Treadwell ($25)	120/6	120/—	120/—	Nov., 1926	4 (d)	
Aramayo Mines (25 frs.)	66/3	62/6	65/—	May, 1928	5 p.c. (†)	
Burma Corpn. (10 rupees)	14/—	13/9	14/—	Aug., 1928	6 annas*	
Bwana M'Kubwa (5s)	7/10½	7/1½	7/9			
Camp Bird (2s)	3/9	3/6	3/7½	April, 1928	3¾ p.c.	
El Oro (£1)	4/3	4/—	4/—	Nov., 1924	2½ p.c.*	
Frontino & Bolivia (£1)	11/—	10/6	10/6	July 1928	3¾ p.c.	
Mexican Corpn.(£1)	9/—	8/3	9/—			
Mexico Mines of El Oro (£1)	26/10½	16/3	22/6	Dec., 1926	3¾ p.c.*	
Mond Nickel	77/6	73/9	75/—	Aug., 1928	20 p.c.	
N'Changa Copper Mining	20/7½	20/—	20/6			
Oroville Dredging (£1)	3/9	3/6	3/9	Dec., 1923	3¾ p.c.	
Rhodesian Congo Border (£1)	35/7½	32/9	35/—			
St. John del Rey (£1)	11/6	11/1½	11/6	April, 1928	7½ p.c.	
San Francisco Mines (10s)	27/4½	26/6	27/3	July 1928	12½ p.c.	
Santa Gertrudis (£1)	14/6	13/9	14/3	July 1928	7½ p.c.	
Selukwe (2s. 6d.)	10/9	9/9	10/3	April, 1917	6¾ p.c.	
S. Amer. Copper (2s.)	2/3	2/1½	2/1½	Nov., 1917	75p.c.	
Tanganyika (£1)	57/9	53/9	56/10½	July 1928	5p.c.	
Union Miniere de Haut-Katanga (Brussels)	10,600	10,525	10,600	July, 1928	182.60 (‡)	

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian frs. and free of taxation. §U. S. Dollars.